Appendix H: Fisheries Biological Assessment and Amendment

Fisheries Biological Assessment Submitted April 13, 2015

Biological Assessment
For
Threatened, Endangered, and Proposed Fish Species
That May be Affected by the
Westside Fire Recovery Project

Happy Camp, Oak Knoll, Salmon River and Scott River Ranger Districts

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PROJECT NAME: Westside Fire Recovery Project
ADMINISTRATIVE UNIT: Klamath National Forest; Happy Camp, Oak Knoll, Salmon River and Scott River Ranger Districts

FOURTH FIELD WATERSHEDS: Upper Klamath River, Scott River, Salmon River, and Lower Klamath River

FIFTH FIELD WATERSHEDS:

- Beaver Creek
- Elk Creek
- Horse Creek-Klamath River
- Humbug Creek-Klamath River
- Indian Creek
- Lower Scott River
- North Fork Salmon River
- Seiad Creek-Klamath River
- South Fork Salmon
- Thompson Creek-Klamath River
- Ukonom Creek-Klamath River

SEVENTH FIELD WATERSHEDS: See list in Appendix B and D

WATERSHED ANALYSES: See list in References

NEPA DOCUMENTATION: Westside Fire Recovery Project EIS (in progress)

ESA LISTED SPECIES: Southern Oregon/Northern California Coasts Coho salmon (*Oncorhynchus kisutch)*

ESA CRITICAL HABITAT: Southern Oregon/Northern California Coasts Coho salmon CH

ESA DETERMINATIONS: May affect, but not likely to adversely affect Southern Oregon/Northern California Coasts Coho salmon ESU or their designated CH.

ESSENTIAL FISH HABITAT (EFH): The Westside Fire Recovery Project may adversely affect EFH for Coho and Chinook salmon, specifically EFH for Southern Oregon/Northern California Coasts Coho salmon and Upper Klamath-Trinity Rivers Chinook salmon.

I. Introduction

The purpose of this biological assessment (BA) is to determine effects of the Klamath National Forest's (KNF) Westside Fire Recovery (WSFR) Project (the Project) on Coho salmon, the only anadromous fish species listed under the Endangered Species Act (ESA) within the Project Analysis Area and on designated Critical Habitat (CH) for Coho salmon. Also considered are effects on Coho and Chinook salmon Essential Fish Habitat (EFH) designated under Magnuson-Stevens Fisheries Conservation and Management Act (MSFCMA). Species listed as "sensitive" by the Pacific Southwest Region of the USDA Forest Service are analyzed in the WSFR Project Aquatic Resources Report (WSFR Project EIS, in progress).

The WSFR Project EIS includes 4 action alternatives for salvage of burned trees within three areas burned by wildfires in 2014: Beaver Fire, Happy Camp Complex and Whites Fire. Alternative 2, the proposed action, was designed to meet the purpose and need for action and will treat a total of about 63,900 acres within the 218,000 acre project boundary. As a result of public input and streamlined consultation with USFWS and NMFS, the proposed action has been changed and reduced in scope and potential environmental impact. This modified Alternative 2 is the action analyzed in this BA and is referred to as the Consultation Action.

The Analysis Area is the following 5th-field watersheds (and 7th field subwatersheds) within the three major burn areas that were affected by the 2014 fires that have proposed activities:

- Beaver Creek
- Elk Creek
- Horse Creek-Klamath River
- Humbug Creek-Klamath River
- Indian Creek
- Lower Scott River
- North Fork Salmon River
- Seiad Creek-Klamath River

- South Fork Salmon
- Thompson Creek-Klamath River
- Ukonom Creek-Klamath River

This BA is prepared in accordance with legal requirements set forth under Section 7 of the ESA of 1973, as amended, [16 U.S.C. 1531 et. seq. 50CFR 402], EFH consultation under 305 (b) (4) (A) of MSFCMA and is consistent with standards established in Forest Service Manual direction (FSM 2672.42; USFS 1991). The BA analyzes effects to the following Evolutionary Significant Units (ESUs) and EFH of anadromous fish and their habitat:

Endangered: None
Threatened: Southern Oregon / Northern California Coasts (SONCC) ESU Coho salmon
(*Oncorhynchus kisutch*) (70 FR 37160, June 28, 2005), and it's designated CH (64 FR 24049, May 5, 1999)
Proposed: None
Candidate: None
EFH: SONCC Coho salmon
Upper Klamath-Trinity (UKT) Rivers Chinook salmon (*O. tshawytscha*)

APPENDICES: Supporting documents to this BA are located in the following appendices:
Appendix A. Project maps
Appendix B Detailed tables of proposed activities and CWE model outputs
Appendix C. KNF Table of Population and Habitat Indicators
Appendix D. Environmental Baseline and Effects Checklists, 5th and 7th field watersheds
Appendix E. Project Design Features, Best Management Practices and Wet Weather Operation Standards
Appendix F. Life history and biological requirements of Pacific Salmonids
Appendix G. Summary of Project Element Effects to Coho Salmon, and Critical Habitat, by 2014 Fire Area

II. Consultation to Date

A list of Threatened, Endangered, and Candidate species was obtained online from the Arcata FWS office website on January 21, 2014 (FWS 2014). This list was used as a basis for determining which species listed under the ESA would be included in this BA.

A NMFS representative (Don Flickinger) attended field reviews with US Forest Service personnel on: 10/27/14, 12/3/14, 1/8/15, 3/5/15, and 4/3/15. The WSFR Project was discussed with D. Flickinger in detail (including map and project design feature review) at Level 1 meeting on 1/7/15 and Project interdisciplinary team meetings on 1/9/15 and 3/20/15. Information sharing and incorporation of minimization measures to protect Coho salmon continued with D. Flickinger as the project developed (from October 2014 to present). A draft BA was submitted to D. Flickinger on 4/1/15. Comments from D. Flickinger were received on 4/9/15 and 4/11/15. Comments were reviewed and discussed together on 4/10/15 and 4/13/15. The BA was finalized on 4/13/15.

III. Proposed Action

The proposed action includes five Project Elements (PEs):

- Salvage and Reforestation
- Fuels Reduction
- Hazard Tree Removal
- Temporary Roads, Landings and Water Drafting
- Legacy Site Treatments

Maps showing the locations of all PEs and Coho salmon CH are provided in Appendix A; Appendix B has detailed tables of proposed actions and Cumulative Watershed Effects modelling by 7th field watershed. Watershed Project Design Features (PDFs) were developed by watershed specialists during project development to minimize potential impacts to soils and riparian/aquatic resources; these PDFs are included in Appendix E (and the full list of PDFs is in the project FEIS).

Project Summary

Type of Project: Post-fire Salvage Harvest

PE Information (all acres are approximate):

1) Salvage and Reforestation

The WSFR Project proposes salvage harvest on about 7,829 acres within the three areas burned by the 2014 fires (Beaver Fire, Happy Camp Complex and Whites Fire). See Table 1 and 2 for acres of salvage harvest proposed by 5th field watershed). The following criteria were used to establish the areas for salvage harvest treatments: No salvage harvest within Wilderness, Backcountry, Research Natural Areas, Designated or Recommended Wild Rivers, Inventoried Roadless Areas, or RRs associated with stream channels (hydrologic RRs); areas proposed for treatment include only 1) Areas of moderate to high severity vegetation mortality (i.e. greater than 50 percent of trees fire-killed on a unit level, based on Rapid Assessment of Vegetation Condition after Wildfire (RAVG)); 2) Areas determined to be feasible in terms of logging systems, accessibility, and economics; and 3) Areas with more than 10 contiguous acres of medium to high severity vegetation mortality. Land allocations are defined in the KNF's Land and Resource Management Plan (LRMP) (USFS 1995a). In determining what individual trees will be harvested, standing dead trees 14 inches in diameter at breast height or greater will be considered for salvage using the guidelines in Report #RO-11-01 "*Marking Guidelines for Fire-Injured Trees in California*" (Smith & Cluck, 2011) to identify trees for removal. These guidelines were developed using peer reviewed scientific literature to evaluate tree species in Northern California for mortality. Treatment of slash/activity fuels associated with salvage logging may include jackpot burning, heli-torch burning, pile or windrow burning, and/or lop and scatter, as necessary. All skid trails and yarding corridors will be rehabilitated at Project conclusion, including installation of water bars, scattering slash, and other measures deemed necessary to control soil erosion and minimize potential impacts to water quality (as per BMPs and Watershed PDFs).

Salvage harvest would be accomplished using ground-based [tractor/end line], skylining, and helicopter methods. All salvage units will be reforested with the need for site-preparation evaluated per criteria outlined in site-preparation section below.

Reforestation includes site-preparation, planting, and release over approximately 7,873 acres to increase the likelihood and speed by which burned areas are reforested and will

include: manual site preparation, skyline yarding, mastication, mechanical yarding and slash piling of dead trees. Treatments within RRs are proposed within the plantation site-preparation and planting units in the Whites Fire and Happy Camp Complex to achieve ground cover and encourage natural recovery of vegetation and soils. Treatment will be focused in areas of high and moderate vegetation mortality and where the overhead hazards can be mitigated without equipment entry into RRs. Trees up to 16 inches diameter at breast height in RR may be cut and felled. Treatment will include hand-work only (no ground-based equipment) and lop-and-scatter or other fuels reduction will be implemented if fuel loading is above seven tons per acre; fuels may be hand-piled or windrowed and burned.

Table H-1. 2014 fire areas wtih acres of salvage harvest by method, acres of site preparation, and relevant minimization measures (PDFs).

	Beaver Fire	Happy Camp Complex	Whites Fire	Grand Total
Site Prep and Plant	1,782	5,437	654	7,873
Logging System				
Ground-based	243	595	41	879
Skyline	106	4,234	238	4,579
Helicopter	0	3,899	462	4,361
Total	**350**	**8,728**	**741**	**9,819**
Watershed PDFs	Wet weather operations PDF-1; Skid trail and erosion control: PDFs 2, 7, 8, 10, 27, 28, 29, 30 and 32; Tractor harvest limitations: PDFs 3,4,7,9,12,14 and 26; Cable harvest limitations PDFs 3, 6 and 31.			
Total Acres of RRs within Harvest Units	**1,990**			

Table H-2. Acres of salvage harvest by 5th field watershed.

Watershed	Acres
Beaver Creek	129
Elk Creek	651
Horse Creek-Klamath River	221
Humbug Creek-Klamath River	0
Lower Scott River	1619
Indian Creek	0
North Fork Salmon River	741
Lower Scott River	0
North Fork Salmon River	0
Seiad Creek-Klamath River	6107
South Fork Salmon River	0
Thompson Creek-Klamath River	350
Ukonom Creek-Klamath River	0

2) Fuels Reduction

Fuels treatments will occur on approximately 22,307 acres (Table 3) across the three burn areas and will include hand work, mechanical thinning, mastication, lop and scattering, chipping, broadcast burning, jackpot burning, and pile burning. Table 4 shows fuels treatments proposed, by 5th field watershed.

Table H-3. Summary of fuels treatment and acres.

	WSFR Project
Acres of Fuels Treatment	22,307
Acres of RRs in Units	6,206
Watershed PDFs	Prescribed fire limitations: 33, 35 and 36 Handpiling and burning limitations: 34

Table H-4. Acres of fuels treatment by type within 5th field watersheds.

Watershed	Fuels Management Zone (acres)	Roadside (acres)	Understory Prescribed Fire (acres)	WUI (acres)	Total Acres of Fuels Treatment (acres)
Beaver Creek	325	204	0	196	725
Elk Creek	800	1,426	888	224	3,336
French Creek-Scott River	0	0	0	0	0
Horse Creek-Klamath River	487	340	0	276	1,104
Humbug Creek-Klamath River	141	65	0	141	348
Indian Creek	0	0	0	0	0
Lower Scott River	637	0	59	400	1,096
North Fork Salmon River	625	807	8,979	413	10,824
Seiad Creek-Klamath River	1,186	847	278	220	2,530
South Fork Salmon River	293	0	230	0	523
Thompson Creek-Klamath River	388	736	296	246	1,666
Ukonom Creek-Klamath River	13	0	35	108	156
Total Acres	**4,895**	**4,424**	**10,765**	**2,223**	**22,307**

3) Hazard Tree Removal

Hazard tree removal will occur along an estimated 678 miles of roads (or within ~21,000 acres), including Forest Service system roads, County Roads, and State Highways to provide for public and forest worker safety and future fire suppression efforts. Both the mileage and acres of treatment proposed are a maximum; the numbers are representative of the entire length and area being evaluated for hazard tree identification and removal. Hazard trees will be identified, felled, and removed in compliance with Region 5 Hazard Tree Guidelines (USFS 2012). All trees within 250 feet of road systems will be evaluated as to hazard, regardless of burn severity. Additional guidance will be used for burned trees to determine mortality potential and, thus, need for removal (USFS 2011a). To be considered a hazard, burned trees must have a 60% or greater chance of dying. Treatment of slash associated with hazard tree abatement may include jackpot burning, pile and

windrow burning, chipping, and/or lop and scatter, as necessary. Project design features require retaining hazard trees greater than 26 inches DBH on site when they are within one site tree height distance from fish-bearing streams.

Table H-5. Acres of hazard tree removal.

	WSFR Project
Acres of Hazard Tree Removal	21,000
Miles of Road Treated	678
Acres of RR within Units	5,600
Watershed PDFs	Equipment exclusion within RRs: PDFs 4 and 13 Maintain large wood, leave felled trees: PDF 14 Maintain soil stability near streams: PDF 15 and 16

Table H-6. Acres of hazard tree removal by 5th field watershed.

Hazard Tree Removal Acres	20499
Beaver Creek	1319
Elk Creek	3772
Horse Creek-Klamath River	1388
Humbug Creek-Klamath River	410
Indian Creek	1
Lower Scott River	3811
North Fork Salmon River	2484
Seiad Creek-Klamath River	4570
South Fork Salmon River	232
Thompson Creek-Klamath River	2448
Ukonom Creek-Klamath River	65

4) Temporary Roads, Stream Crossings, Landings and Water Drafting

About 16.4 miles of temporary road actions are proposed; which involves nine stream crossings. About 3.4 miles of new temporary road would be constructed. Seven of the nine crossings are over intermittent channels: none of the stream crossings are within anadromous salmonid habitat (or resident trout habitat).

Table H-7. Summary of miles of temporary roads and number of stream crossings.

	WSFR Project Road Elements
Miles New Temp. Road	3.4
Miles Temp. Road Existing Alignment	7.3
Miles Reopened Decomm. Roads	5.6
Total Miles of Temporary Road Construction	**16.4**
# of Temp Road Stream Crossings	9
# of Temp Road Stream Crossings in anadromous salmonid habitat	0
Watershed PDFs	New temporary roads: PDFs 5, 23, 24 Watering roads: PDFS 18 Culvert replacements 20 Water drafting 37, 38.

Table H-8. Summary of temporary road miles by 5th field watershed.

5TH-FIELD	Reopen Decomm. Road	Temp. Roads Existing Roadbed	Temp. Roads New	Total Miles
Beaver Creek	0	0.8	0	0.8
Elk Creek	0.7	1.5	0.2	2.4
Horse Creek-Klamath River	0	0.4	0	0.4
Humbug Creek-Klamath River	0	0	0	0
Indian Creek	0	0	0	0
Lower Scott River	0	1.1	0.2	1.4
North Fork Salmon River	0	0.6	0.1	0.7
Seiad Creek-Klamath River	4.0	2.0	2.9	8.9
South Fork Salmon River	0	0.1	0.0	0.1
Thompson Creek-Klamath River	0.9	0.8	0	1.8
Ukonom Creek-Klamath River	0	0	0	0
Total Miles	**5.6**	**7.3**	**3.4**	**16.4**

A maximum of 75 existing landings will be used and 135 new landings will be constructed. Maps in Appendix A show locations of landings. Landing size will be commensurate with operational safety. Helicopter landings will be up to two acres in size. Skyline landings will use roads where ever possible. New skyline landings off the road system and ground-based landings will average one acre in size but will not be larger than 1.5 acres in size. Both new and existing landings will be hydrologically stabilized after use.

Table H-9. Number and type of landings within 5th field watersheds.

5th-field Watershed	Existing Landings	New Landings	Total
Ground Based Landing			
Beaver Creek	11	7	18
Horse Creek-Klamath River	14	12	26
Lower Scott River	4	3	7
North Fork Salmon River	0	0	0
Seiad-Creek-Klamath River	12	6	18
Thompson Creek-Klamath River	0	12	12
Total	**41**	**40**	**81**
Helicopter Landing			
Elk Creek		6	6
Lower Scott River	15	10	25
North Fork Salmon River	5	1	6
Seiad-Creek-Klamath River	14	29	43
Thompson Creek-Klamath River		6	6
Total	**34**	**52**	**86**
Skyline Landings			
Elk Creek		12	12
Lower Scott River		8	8
North Fork Salmon River		7	7
Seiad-Creek-Klamath River		11	11
South Fork Salmon River		1	1
Thompson Creek-Klamath River		4	4
Total		**43**	**43**
Total number of landings	**75**	**135**	**210**

5th-field Watershed	Existing Landings	New Landings	Total
New Landings in RRs	Landings # DZ03, DZ10, DZ23, L043, L044, and L090.		
Watershed PDFs	Use of existing landings: PDF 26 Expansion of landings: PDF 26 Erosion control on landings: PDF 26 Restoration of soil cover: PDF 26		

During project planning watershed specialists worked with logging systems specialists to minimize any proposed new landings in RR. Several were proposed, and not approved for use by watershed specialists who are directed to shape projects to meet direction to *maintain and restore* aquatic ecosystems. Several new landings within RR were approved for use (PDF Watershed-5). Variables that provided for field-surveyed landings to be approved for use by watershed specialists included if they were on stable landforms and slope positions, were in the outer zone of the Riparian Reserve, and/or were separated from perennial streams by existing, stable road segments. Landings in RR were not approved for use if they would require removal of mature green vegetation or significant earthwork or fill (several initially proposed landings near Walker Creek, Grider Creek, and Whites Gulch were dropped for these reasons). The following new landings in RR were approved as exceptions to PDF Watershed-5 (shown on project maps in Appendix A):

- Proposed landings **L043, L044, and DZ23** occur in RR above the 46N66 road as it heads up the hill near Grider Creek Campground. These three landings would be used to facilitate helicopter logging systems in the Grider Creek watershed.
- Proposed landing **DZ03** is within RR of the Klamath River on a barren mine tailing area about 300 feet north of the river. It would be used to facilitate helicopter logging systems in the Gard and Caroline Creek area between Walker and Grider creek confluences with the Klamath River.
- Proposed landing **L090** is within RR of upper Cliff Valley Creek. It would be used to facilitate skyline logging systems.
- Proposed landing **DZ10** is within RR of lower Scott River. It would be used to facilitate helicopter logging systems.

Water drafting will occur at existing water drafting sites (locations are shown on maps in Appendix A). The number of sites needed and locations of use are not known at this time, therefore Table 10 lists all existing sites in each 5th-field watershed that could potentially be used. Watershed PDFs (37 and 38) will be implemented to minimize effects of water drafting on sediment and aquatic species including the following: draft water only at designated water drafting sites; coordinate with KNF fisheries biologists so effects to thermal refugia are avoided; when drafting from waters designated as Coho salmon CH, implement NOAA Fisheries Water Drafting Specifications (2001) and implement Forest Service BMPs outside of CH.

Table H-10: Number of existing water drafting sites in 5th field watersheds.

5th-field Watershed	Number of Water Drafting Sites
Beaver Creek	64
Elk Creek	39

5th-field Watershed	Number of Water Drafting Sites
Horse Creek-Klamath River	108
Humbug Creek-Klamath River	27
Indian Creek	71
Lower Scott River	29
North Fork Salmon River	32
Seiad Creek-Klamath River	87
South Fork Salmon River	34
Thompson Creek-Klamath River	42
Ukonom Creek-Klamath River	41

5) Legacy Sediment Site Treatments

Legacy sediment site treatments are considered connected actions. Restoration actions would occur at existing legacy sediment sites, scheduled for treatment in compliance with the Clean Water Act as a condition of the North Coast Regional Water Quality Control Board waiver of waste discharge requirements (Order No. R1-2010-0029). Most legacy site treatments are proposed within the Elk Creek watershed, per agreements made during Clean Water Act consultation. However, project use of temporary roads would also require treatment of existing legacy sites at several sites in lower Grider Creek, Kuntz Creek, and O'Neil Creek drainages.

The portion of Elk Creek within the project area contains about 148 legacy sites and most sites are located on or adjacent to the Forest transportation system. Other legacy sites are located on historical landings or roadbeds (historic roads, abandoned temporary roads, or decommissioned roads). In lower Grider Creek drainage, an existing legacy sediment site at a perennial stream crossing on 46N41YA would be properly hydrologically stabilized after use by the project. In lower Kuntz and O'Neil creeks, project use of existing non-system roadbeds would require proper hydrologic stabilization of these areas; fixing road drainage problems would address potential risks to water quality from these roads.

Table H-11. Legacy sediment site treatments in Elk Creek Watershed.

Legacy Site Type	# of Sites
Culvert Upgrades to accommodate 100 year event	45
Diversion Prevention	51
Replace Culvert with Bottomless Arched Culvert	3
Retaining Wall	7
Fill Reduction	16
Fill Removal from stream channels, swales, shoulders on Closed Roads	27
Repair Culvert: clean and repair; place rip rap to reduced erosion	16
Road Storm Proofing	33 miles: Forest system roads (15N02, 15N75, 16N05, 16N39 and 45N19)

Legacy Site Type	# of Sites
# of Legacy Sites within CH	0

Project Timing: Project implementation is planned to begin in the summer/fall of 2015. The Project duration for salvage harvest and hazard tree abatement is anticipated to be two years, in 2015 and 2016. Fuels treatments would occur within 10 years after the WSFR Project Decision. Because burning activities are dependent upon weather conditions and staff availability, it may continue for several years following completion of the rest of the project. The schedule for legacy repair actions in Elk Creek watershed is projected to start in 2017, and will be determined through consultation with the North Coast Water Quality Control Board and funding availability.

Resource Protection Measures: The proposed action includes project design features (PDFs) designed to avoid and/or minimize potential environmental effects. Fisheries biologists and other watershed specialists developed PDFs specifically for watershed protection, and implementation of these measures is critical in avoiding adverse effects to aquatic habitat and Coho salmon in both the short and long term. Watershed PDFs are in Appendix E (see also Project EIS, Chapter 2 for the comprehensive list of PDFs).

Best Management Practices (BMPs): These practices were developed in coordination with the State of California Water Quality Control Board to protect water quality (see Appendix E).

Wet Weather Operation Standards (USFS 2002) are included within BMPs and PDFs will be used to guide operations during periods of wet weather (see Appendix E).

IV. Description of the Action Area

The WSFR Project Analysis Area includes the ~214,000 acres burned in 2014 by the Beaver Fire, Happy Camp Complex and Whites Fire. The Beaver Fire area is located north of the Klamath River near Oak Knoll, the Happy Camp Complex is south of the Klamath River between Scott Bar and Happy Camp, and the Whites Fire is upstream of Sawyers Bar, in the North Fork Salmon River basin.

The ESA Action Area is the 5th-field watersheds (and their 7th field subwatersheds or drainages) that provide habitat for Coho or Chinook salmon within the three major burn areas that have proposed activities:

- Beaver Creek
- Elk Creek
- Horse Creek-Klamath River
- Humbug Creek-Klamath River
- Lower Scott River
- North Fork Salmon River
- South Fork Salmon River
- Seiad Creek-Klamath River
- Thompson Creek-Klamath River
- Ukonom Creek-Klamath River

The Project Action Area extends downstream to the confluence of the Klamath and Salmon Rivers. The Action Area provides habitat for Southern Oregon/Northern California Coasts Coho salmon (*Oncorhynchus kisutch;* Coho salmon), listed as Threatened under the ESA, and their designated CH. EFH for Coho and Chinook salmon occurs within the Action Area, and is identical to the distribution of Coho salmon CH as shown on maps in Appendix A.

The distribution of anadromous fish and their habitat within the Action Area is based on existing stream survey information collected by or verified by KNF fisheries biologists. The status and general life history of Coho salmon and Chinook salmon is provided in Appendix F.

V. Analysis Methods

Special Status Species. A list of Threatened, Endangered, and Candidate species was obtained online from the NMFS website at http://www.nmfs.noaa.gov/pr/species/esa/listed.htm#fish

Habitat information came from the KNF LRMP, watershed analyses conducted by the KNF, existing stream survey data and reports and other environmental analyses completed for projects within the Analysis Area.

The Analytical Process. This analysis uses habitat indicators from the Analytical Process for Developing Biological Assessments for Federal Actions Affecting Fish Within the Northwest Forest Plan Area (USDA-USDOC-USDI 2004). The Analytical Process (AP) utilizes key indicators of habitat quality (habitat indicators) and was formulated to standardize evaluations of actions and effects for conferencing/consultations under Section (§) 7(a)(2) of the ESA, focusing on salmonid fishes within the Northwest Forest Plan (NFP) area. The information developed through the AP generally also satisfies the information requirements for EFH consultation for Pacific salmon under the MSFCMA and its implementing regulations (50 CFR Part 600).

1. The AP involves several steps including assembling and presenting the best available scientific and commercial information (from a variety of sources, including watershed analysis, NEPA analysis, and other analyses used to implement land and resource management plans) and, developing a BA using analytical procedures that are based upon requirements specified in 50 CFR § 402.12(f) and described in the ESA consultation handbook (USDI and USDC 1998).

2. The AP includes use of the "USFWS/NOAA Fisheries Table of Population and Habitat Indicators" (the Table), which is a tool to characterize baseline habitat and populations for salmonids in the NFP Area. Habitat indicators are evaluated in the Table, and the AP allows for criteria values to be adjusted for local watershed conditions given supportive documentation. Consistent with the Matrix of Pathways and Indicators (NMFS 1996) the Table provides values and ranges of conditions to determine whether baseline conditions are *Properly Functioning*, *At Risk*, or *Not Properly Functioning*. The KNF has developed criteria for the mid-Klamath region using values from streams that are considered pristine and as supported by the data contained in the environmental impact statement for the Klamath LRMP. The Klamath tributaries matrix (Appendix D) serves as the basis to identify relative baseline conditions, including existing conditions for the WSFR Project.

This information, as well as watershed assessments, reports, and field reviews were used to rate and describe existing conditions, and to evaluate effects.

3. The environmental baseline for the full suite of habitat indicators provided in the AP, by 5th and 7th field watershed, are included as part of this analysis via summary in "Checklists for Documenting Environmental Baseline and Effects of Proposed Actions on Relevant Indicators" (see Appendix D). Each indicator is analyzed at the watershed and drainage scale, including the pre-project, post-fire environmental baseline and effects of the proposed action. Table 12 lists the suite of habitat indicators from the AP.

Table H-12. Analytical Process habitat indicators by category.

Indicator	Habitat: (non-watershed condition indicators)	Habitat: (watershed condition indicators)
Temperature	■	
Suspended sediment-intergravel dissolved oxygen/turbidity	■	
Chemical contaminants/nutrients	■	
Physical barriers	■	
Substrate character and embeddedness	■	
Large woody debris	■	
Pool frequency and quality	■	
Large pools	■	
Off-channel habitat	■	
Refugia	■	
Average wetted width/maximum depth ratio in scour pools in a reach	■	
Streambank condition	■	
Floodplain connectivity	■	
Change in peak/base flows	■	
Increase in drainage network	■	
Road density and location		■
Disturbance history		■
RRs		■
Disturbance regime		■
Summary/integration of all species and habitat indicators		

The BA effects analysis uses the following steps provided in the AP: Step 1-Identify all PEs; Step 2-Evaluate all of the PEs for each habitat indicator by eight factors in relation to the Environmental Baseline; Step 3-Provide a summary statement for each PE; Step 4-Combine the element summaries for each indicator into a single indicator summary; Step

5-Evaluate Watershed Condition Indicators for potential effects; and Step 6-Answer the questions in the Project Effects Determination Key for all indicator summaries.

Non-WCI Analysis Indicators. This BA groups the non-WCI habitat indicators into three major headings or divisions as follows, based on the pathways for potential effects and, in turn, the potential for impacts on anadromous salmonids and their habitat:

1. Sediment

- Suspended sediment-intergravel dissolved oxygen/turbidity
- Physical barriers
- Substrate character and embeddedness
- Pools - frequency and quality, large pools, average wetted width/maximum depth ratio in scour pools in a reach
- Off-channel habitat
- Change in peak/base flows
- Increase in drainage network -roads.

2. Water Quality

- Water Temperature
- Turbidity
- Chemical contaminants/nutrients
- Physical barriers
- Pool quality
- Refugia
- Change in peak/base flows

3. Riparian Function

- Water Temperature - Stream Shade
- Large woody debris and pool quality
- Off-channel habitat
- Streambank condition
- Floodplain connectivity'

Habitat indicators will be addressed under each of the above three divisions. Effects of each PE will first be discussed, then summarized using the AP factors of Proximity, Probability and Magnitude. Consistent with the AP, PEs with insignificant, discountable, or no effects will not receive further factor analysis (Distribution, Frequency, Duration, Timing, and Nature**)**.

Intensity of Effects. "Intensity" refers to the severity of effects or the degree to which an action may adversely or beneficially affect a species or its habitat. The intensity definitions used throughout this analysis are described below.

Habitat Indicators. Effects to habitat Indicators and anadromous salmonid habitat are described using the following terms:

- Neutral Effect. The action has no effect.
- Beneficial Effect. Effect is contemporaneous positive effects without any adverse effect to the species.

- Discountable Effect. Effect is extremely unlikely to occur and based on best judgment, a person would not be able to meaningfully measure, detect, or evaluate insignificant effects.
- Insignificant Effect. Effect may occur but is not to a level that can be meaningfully measured or detected.
- Significant Effect. Effect is detectable, and may be meaningfully measured.

Species. Effects to Coho salmon are described using the following terms:

- Neutral Effect. The action has no effect.
- Beneficial Effect. Effects are contemporaneous positive effects without any adverse effects to the species.

Insignificant Effect. Effect may occur but is not to a level that can be meaningfully measured or detected.

- Minor Effect. Effects would result in detectable effects to an individual/s of a listed species or its CH, but they would not be expected to result in substantial population fluctuations and would not be expected to have any measurable long-term effects on species, habitats, or natural processes sustaining them; minor effects equate with a "*May Affect/Not Likely to Adversely Affect*" determination.
- Moderate Effect. Effects would result in detectable impacts on individuals or population of a listed species, its CH, or the natural processes sustaining them and key ecosystem processes may experience disruptions that may result in population or habitat condition fluctuations that would be outside the range of natural variation, but would return to natural conditions; moderate level adverse effects would equate with a "*May Affect/Likely to Adversely Affect"* determination.
- Major Effect. Individuals or population of a listed species, its CH, or the natural processes sustaining them would be measurably affected and key ecosystem processes might be permanently altered resulting in long-term changes in population numbers and permanently modifying CH; major effects may result in jeopardy to the continued existence of a population unit, ESU, or species.

Spatial and Temporal Bounding. The Action Area is the 5th-field subwatersheds of the Middle Klamath River and their 7th field drainages that provide habitat for Coho or Chinook salmon that were affected by the 2014 fires and have proposed activities. Upstream extent of the Action Area is defined as Beaver Creek in the Klamath River, Kelsey Creek in Scott River, and North Russian Creek in Salmon River. Downstream the Action Area extends to the confluence of Salmon and Klamath Rivers.

The temporal bounding of the analysis includes short-term effects (during implementation or within one year of implementation) and long-term effect (chronic effect that persists longer than one year after implementation).

VI. Environmental Baseline and Biological Requirements

The Action Area provides habitat for Southern Oregon/Northern California Coasts Coho salmon (*Oncorhynchus kisutch*), listed as Threatened under the ESA, and their designated CH. Forest Service Sensitive fish species that may occur within the Analysis Area

include Upper Klamath-Trinity Rivers Chinook (*Oncorhynchus tshawytscha*), Klamath Mountains Province Steelhead (*Oncorhynchus mykiss*), Klamath River lamprey (*Entosphenus similis*), and Pacific lamprey (*Entosphenus tridentatus*). Both steelhead and resident rainbow trout (*Oncorhynchus mykiss*) are management indicator species under the KNF Forest Plan. EFH for Coho and Chinook salmon occur within the Action Area, and is considered identical to the distribution of Coho salmon CH in this document.

The biological requirements of Coho and Chinook salmon are given in Appendix F. The environmental baseline is given as a narrative below for each fire area and is focused on 5th-field watersheds. The Environmental baseline for HUC 7 watersheds in the Action Area is summarized in tables in Appendix D.

Overall, the water quality in the Klamath River is impaired and is on the 303(d) Clean Water Act list due to temperature and other constituents (Table 13). Use of mainstem habitat by salmonids is most limited by water quality during the summer months (June through September) when water temperatures are high throughout the day. Juveniles must utilize tributaries and other off-channel thermal refugial areas where cooler water can be found.

Table H-13. Clean Water Act 303(d) listed reaches of the Middle Klamath River (NCRWQCB 2008).

Waterbody	Pollutant
Middle Klamath River HA, Iron Gate Dam to Scott River Reach	Nutrients, Organic Enrichment/Low Dissolved Oxygen, Temperature
Middle Klamath River HA, Iron Gate Dam to Scott River Reach, mainstem Klamath	Microcystin
Middle Klamath River HA, Beaver Creek, Cow Creek, Deer Creek, Humgry Creek, West Fork Beaver Creek	Sediment
Middle & Lower Klamath River HAs, Scott River to Trinity River Reach	Nutrients, Organic Enrichment/Low Dissolved Oxygen, Temperature
Middle & Lower Klamath River HAs, Scott River to Trinity River Reach, mainstem Klamath River	Microcystin
Middle & Lower Klamath River HAs, China Creek, Fort Goff Creek, Grider Creek, Portuguese Creek, Thompson Creek, Walker Creek	Sediment
Salmon River HA	Temperature
Scott River HA	Sedimentation/Siltation, Temperature

Beaver Fire

The 2014 Beaver Fire burned approximately 43,327 acres in the following 5th-field watersheds:

- Beaver Creek (16,303 acres burned)
- Horse Creek-Klamath River (21,244 acres burned)

- Humbug Creek-Klamath River (5,780 acres burned)

Aquatic Resources

Beaver Creek is tributary to the Klamath River and the watershed provides approximately 31 miles of CH for SONCC Coho salmon, habitat for winter and summer-run KMP steelhead, and EFH for spring and fall-run UKT Chinook salmon. Tables in Appendix B list the HUC 7 drainages and miles of anadromous salmonid habitat in each. Beaver Creek also provides habitat for Pacific lamprey and other native aquatic species. The Beaver Creek Ecosystem Analysis (USFS 1996) contains more detailed watershed information. Natural barriers exist in tributaries to Beaver Creek: anadromous salmonids cannot access many tributaries including Smokey Creek, Deer Creek and Upper West Fork Beaver Creeks. KNF Chinook spawning surveys indicate that approximately 77% of fall Chinook salmon utilize the lower five miles of Beaver Creek between the mouth and Beaver Creek campground, 22% utilize a four mile reach upstream of the campground, and 1% utilize a reach 9-15 miles upstream of the mouth (USFS 1996). Most of the stream channels in this watershed drain forested mountainous areas. At the present time, there are no known runs of spring Chinook or summer steelhead in Beaver Creek. SONCC Coho salmon CH overlaps with fall Chinook salmon distribution in the Beaver Creek watershed, while also including the lower four miles of Grouse Creek. SONCC coho salmon CH is also found in the Klamath River adjacent to the the watersheds affected by the Beaver Fire, including the lower reaches and confluence zones of Doggett and Kohl Creeks with the Klamath River, and in the lower two miles and seven miles of Buckhorn and Horse Creeks, respectively.

Table H-14. Beaver Fire 7th field watersheds, burn acres and miles of Coho CH.

Beaver Fire HUC 7 Watersheds	Beaver Fire Burned Acres	Total Miles of Anadromous Salmonid Habitat/Miles Within Analysis Area
Bear Creek	0.9	1.7/0
Buckhorn Creek	3,028.9	2/0
Buckhorn Gulch-Beaver Creek	8,233.8	5.7/5.7
Collins Creek-Klamath River	2,301.2	5.6/1.9
Doggett Creek	6,317.0	1.2/0.9
Dona Creek-Klamath River	2,129.9	2.8/2.6
Dutch Creek	3,789.5	0.3/0.3
Jaynes Canyon	229.8	1.5/0
Kohl Creek	4,053.4	0.9/0.9
Little Humbug Creek	3.3	0/0
Lower West Fork Beaver Creek	1,334.3	1.9/1.7
Lumgrey Creek	1,787.1	2.0/0
McKinney Creek	3.6	1.6/0.1
Miller Gulch-Klamath River	3,965.4	5.0/4.7
Quigleys Cove-Klamath River	3,406.3	6.5/3.4
Soda Creek-Beaver Creek	2,715.2	4.4/2.3
Vesa Creek	27.5	0/0
Grand Total	**43,327.1**	**43.1/24.5**

Bear Creek, Collins Creek, Little Humbug, Lumgrey Creek, McKinney Creek, Vesa Creek have no proposed activities and will not be discussed further.

Sediment

The Beaver Creek watershed is on the 303(d) Clean Water Act list as impaired for Sediment (Table 13). Approximately 36% of the watershed is privately owned and managed. Intensive management on private lands and high road density contributes to the high risk ratios in the Beaver Creek 5th-field watershed. In addition, Long John, Grouse Creek and Hungry Creek subwatersheds all have large proportions of granitic soils.

The 2014 fires burned at high severity over 6% of this watershed and 28% burned at moderate severity (Table 15) resulting in significant watershed disturbance in the Beaver Creek 5th-field subwatersheds.

Table 16 provides summary CWE modeling results from Mondry's (2015) WSFR Hydrology Report. This report also includes CWE modeling results for Beaver Fire 7th field subwatersheds, some of which exceed TOC, both before and after 2104 fire effects were modeled. See Appendix B for CWE modeling of effects of this project by 5th and 7th field watershed.

Table H-15. Summary of watershed burn severity for the 2014 Beaver Fire.

Fire Area	Amount of Very Low Severity Acres (%)	Amount of Low Severity Acres (%)	Amount of Moderate Severity Acres (%)	Amount of High Severity Acres (%)	Total Burned (Acres)
Beaver Fire	5,131 (16%)	16,138 (50%)	9,208 (28%)	1,989 (6%)	32,466

Table H-16. Beaver Creek CWE model results at the 5th field watershed scale comparing pre- and post-fire conditions.

5th-field **Watershed**	**Watershed Area (Acres)**	**Pre-Fire (2012)**	**Post-Fire, No Action**	**2014 Fire Area**
Beaver Creek	69,610	0.7	1.0	Beaver Fire
ERA		1.1	1.2	
USLE		0.8	1.1	
GEO				
Horse Creek-Klamath River	98,625	0.7	0.7	
ERA		0.7	0.8	
USLE		0.7	0.9	
GEO				
Humbug Creek-Klamath River	68,023	0.6	0.3	
ERA		0.6	0.5	
USLE		0.8	0.8	
GEO				

Lower Beaver Creek is lower gradient and less confined than upper reaches. Pulses of sediment have overloaded the system during extreme storm events (e.g. 1997 flood) and originate from road failures and washouts. Road density in general is high in this watershed and chronic sediment delivery is a result. Road density within RRs is also high: 4.1 miles per square mile. Grouse Creek and Hungary Creek are recognized as heavy sediment contributors to Beaver Creek and the quality of spawning gravels has been reduced due to sedimentation from roads.

Wildfires result in increased runoff and sediment yield commensurate with burn severity. KNF BAER teams reported that, post-fire, about two thirds of the fire area had low or very low levels of soil burn severity and that the rate of water infiltration into the soil in these areas was not greatly affected. Dutch Creek was the most severely affected tributary: approximately 93% of this subwatershed was burned and had a large area of moderate to high soil burn intensity. BAER teams reported the following information: the highest changes in peak runoff potential are in the Dutch Creek, and Kohl Creek. The Kohl Creek watershed had almost half of its acreages in the fire and is at risk for flooding and sedimentation; many of the intermittent and ephemeral channels in the affected watersheds in the Beaver fire area are full of sediment; and, a significant storm event will mobilize this sediment sending it downhill onto forest roads and downstream to perennial streams such as Beaver, Doggett and Kohl Creeks affecting water quality. Much of the moderate and high soil burn severity areas of the fire was on steep terrain in a checkerboard area of ownership with alternating sections of private land with federal land. These conditions have and will continue to make it very difficult to implement effective hillslope treatments. The most effective action taken post-fire to reduce increased runoff and sedimentation was stormproofing the road system. However, BAER teams observed sediment stored in intermittent and ephemeral channels post-fire. These fine sediments will flush downstream during winter storm events.

The Beaver Creek 5th-field watershed is at or exceeds the threshold of concern (TOC; risk ratios greater than 1.0). KNF CWE assessments model disturbances and land sensitivity and results fall on a continuum. As disturbances increase (and recover) over time and space, at some point, the risk of initiating or contributing to existing adverse cumulative watershed impacts becomes a cause for concern. These model-specific levels are called “inference points” (or “thresholds of concern” - TOC) and are used to inform land management decisions. Ecologically, a transition exists from lower to higher risk of adverse effects to beneficial uses – from insignificant to potentially significant. From a management perspective, inference points are intended to represent the center of that transition zone. Inference points do not represent the exact point at which cumulative watershed effects will occur. Rather, they serve as “yellow flag” indicators of increasing susceptibility for significant adverse effects occurring within a watershed. The USLE model assumes 10% of mobilized hillslope sediment is delivered to stream channels during the first winter season post-disturbance, and the GEO model requires a storm event with a 10-year recurrence interval (10% chance of annual occurrence) to produce mass wasting.

In addition to CWE modelling, the KNF is actively monitoring stream channel sediment as part of a program to meet North Coast Water Quality Control Board waiver requirements. A primary goal of this monitoring program is to determine *reference conditions* for stream sediment (Laurie and Elder, 2012). KNF watersheds were stratified in to *managed* and *reference* types (primarily at the 6th-field HUC scale), with the reference watersheds used to define desired conditions in the managed basins. A total of 20 reference streams were established, and sampling of reference stream fine sediment (filled pool volume, surface fines, subsurface fines) was used to define thresholds (75th percentile of reference + survey error) for evaluation of conditions in managed streams (Laurie and Elder, 2012). Prior to the 2014 fires, Beaver Creek mainstem met the

sediment reference conditions for all measures of fine sediment (V* and surface and subsurface sediment). The West Fork of Beaver Creek exceeded reference conditions for V* (the fraction of pool volume that is filled with fine sediment).

Decreased interception of rainfall as a result of wildfire as well as increased sediment and runoff delivered to streams, can lead to an increased debris flow probability in the affected watersheds compared to pre-fire conditions. Post-fire debris flow events can degrade or aggrade stream channels and remove riparian vegetation. BAER teams reported that the probability of aquatic habitat being damaged by debris flow is likely and there is a moderate risk of damage to the quality of habitat (for about the next 10-years).

Fire intensity and extent of area burned within RRs is also an indicator of the potential for sedimentation to streams and adverse effects to riparian function. Areas that burned at moderate to high intensity experienced an almost complete loss of soil cover. Where this occurred, the magnitude of impacts would be strongly influenced by the amount of area impacted and the severity of winter storms immediately following the fire and prior to re-establishment of grasses, forbes and shrubs. The duration of impacts would likely be intermediate between short- and long-duration as regrowth of vegetation covers soils and high gradient channels flush stored sediments, dependent on the magnitude of winter runoff.

Table H-17. Burn severity along intermittent and perennial streams in the three project fire areas (data from 2014 BAER assessment reports and derived from BARC data).

Stream Channel Burn Severity						
		Very Low miles (%)	**Low miles (%)**	**Moderate miles (%)**	**High miles (%)**	**Total (miles)**
Happy Camp Complex	Intermittent	23 (9%)	196 (72%)	50 (18%)	2 (0.8%)	271
	Perennial	31 (13%)	188 (76%)	27 (11%)	0.4 (0.2%)	246
Beaver Fire	Intermittent	20 (15%)	66 (50%)	37 (28%)	10 (8%)	133
	Perennial	12 (34%)	18 (51%)	5 (14%)	<1 (<3%)	35
Whites Fire	Intermittent	18 (21%)	43 (50%)	21 (24%)	4 (5%)	86
	Perennial	16 (25%)	36 (57%)	9 (14%)	2 (3%)	63

Post-fire, the Sediment habitat indicator in the Beaver Creek watershed is considered as “at risk” or “not properly functioning” based on modeled risk ratios and expected impacts from the 2014 fires.

Water Quality

Tributaries and upper reaches of Beaver Creek have low summer water temperatures. Although lower reaches of the mainstem Beaver Creek are warmer and diversions exist, temperatures are far cooler than in the Middle Klamath River and are considered “Properly Functioning.” Thus, Beaver Creek provides thermal refugia for anadromous salmonids. However, pool habitat is lacking in Lower Beaver Creek, which limits available space for salmonid rearing.

Table H-18. 2013 water temperature data for Beaver Creek (USFS 2014h).

Location	Date of Maximum MWMT	MWMT (◦C)

Location	Date of Maximum MWMT	MWMT (◦C)
Beaver Creek upstream from West Fork Beaver	7/23/13	18.4
Beaver Creek 1/4 mile upstream of Klamath River	7/27/13	21.2

Riparian Function

RRs in Beaver Creek have a high density of medium to small conifers and other vegetation. The continuity of RRs along Beaver Creek is impacted by the main road and other disturbed sites including recovering mine sites and flood deposits. The Beaver Creek watershed has a large proportion of private industrial timberlands that are managed under the California Forest Practice Rules, which has included harvest within RRs.

The percent of stream channel burned is used herein as indication of the impacts from the 2014 fires to riparian function. Streamside areas that burned at high severity will provide little to no function with respect to sediment retention, stream shade, microclimate moderation and future large wood recruitment immediately post-fire. Moderate severity burn areas will provide reduced function as an estimated 50% of the streamside vegetation was burned.

Pre-fire wood loading in Beaver Creek was determined to be "properly functioning." The 2014 fires had no effect on instream wood levels in the mainstem but will increase short-term wood loading in some areas and reduce large wood available for recruitment in the long-term, especially in areas burned at moderate or high severity.

The Happy Camp Complex Fire Project Area

The Happy Camp Complex Fire burned approximately 131,313 acres within the following 5th-field watersheds (and their HUC 7 subwatersheds):

- Lower Scott River (30,600 acres)
- Elk Creek (34,633 acres)
- Seiad Creek-Klamath River (50,897 acres)
- Thompson Creek-Klamath River (11,243 acres)

Approximately 1% of the area burned at high severity, and 22% at moderate severity.

Table H-19. Summary of watershed burn severity for the 2014 Happy Camp Complex.

Fire Area	Amount of Very Low Acres (%)	Amount of Low Acres (%)	Amount of Moderate Acres (%)	Amount of High Acres (%)	Total (Acres)
Happy Camp Complex	12,472 (10%)	86,814 (67%)	28,182 (22%)	1,439 (1%)	128,907

The WSFR Hydrology Report (Mondry 2015) contains a complete CWE analysis, and model results by 7th field watershed are in Appendix B of this BA. Table 20 summarizes the results of the CWE modeling. ERA post-fire values are relatively low for 5th-field watersheds in the Happy Camp Complex. Numerous 7th field watersheds in the project area exceed the TOC when 2014 fire effects were modeled (see Appendix B tables for post-fire existing condition and effects of the Project CWE values by 5th and 7th field watershed).

Table H-20. Modeled pre- and post-fire CWE, USLE and Mass Wasting (GEO) risk ratios for 5th field watersheds within the 2014 Happy Camp Complex.

5th-field Watershed Name	Pre-Fire (2012)	Post-Fire, No Action
Elk Creek		
ERA	0.5	0.5
USLE	0.1	0.3
GEO	1.0	1.0
Lower Scott River		
	0.1	0.5
ERA	0.1	0.5
USLE	0.3	0.6
GEO		
Seiad Creek-Klamath River	0.6	0.6
	0.3	0.7
ERA	0.5	0.8
USLE		
GEO		
Thompson Creek-Klamath River	0.1	0.4
ERA	0.4	0.3
USLE	0.4	0.5
GEO		

Numerous 7th field watersheds were affected by the Happy Camp Complex and have proposed activities under the WSFR Project.

Table H-21. Happy Camp Complex 7th field watersheds, burned acres and miles of Coho CH.

Happy Camp Complex HUC 7 Watersheds	Happy Camp Complex Burned Acres	Total Miles of Anadromous Salmonid Habitat/Miles Within Project Area
Bear Creek	5,139.0	1.7/0
Benjamin Creek-Klamath River	249.9	8.4/0.8
Big Ferry-Swanson	2,400.7	4.9/1.8
Bishop Creek-Elk Creek	701.4	4.5/0.5
Caroline Creek-Klamath River	1,374.6	3.3/2.3
China Creek	4,298.0	1.7/1.6
Cliff Valley Creek	3,952.5	0/0
Cougar Creek-Elk Creek	3,764.5	5.6/5.6
Deep Creek-Scott River	1,951.5	4.4/3.4
Doolittle Creek	3,735.6	0/0
Franklin Gulch-Scott River	2,858.9	4.8/3.7
Fryingpan Creek-Klamath River	4,407.9	11.6/6.5
Granite Creek	221.4	0/0
Headwaters Elk Creek	2,531.6	0/0
Hoop &Devil-Elk Creek	1,937.2	4.4/3.9
Horse Creek	2,537.3	0/0
Lower East Fork Elk Creek	3,430.0	2.2/2.2
Lower Grider Creek	10,765.2	9.3/9.2
Lower Seiad Creek	2.9	2.9/0
McCarthy Creek-Scott River	6,112.8	5.4/4.5
Middle Creek	4,495.6	1.2/1.2
Middle Elk Creek	1,189.6	2.4/1.4

Happy Camp Complex HUC 7 Watersheds	Happy Camp Complex Burned Acres	Total Miles of Anadromous Salmonid Habitat/Miles Within Project Area
Negro Creek	11.2	0/0
North Fork Kelsey Creek	5,176.6	0.9/0.9
O'Neil Creek	2,429.2	0.9/0.9
Perkins Gulch-Indian Creek	23.6	2.2/0.2
Rainy Valley Creek	1,486.5	0/0
Rancheria Creek	4,374.5	0/0
Sambo Gulch-Klamath River	27.3	4.9/0.3
Schutts Gulch-Klamath River	2,176.2	5.2/4.0
South Fork Kelsey Creek	1,787.8	1.1/1.1
Tom Martin Creek-Klamath River	8,759.5	6.1/5.4
Tompkins Creek	9,327.2	5.2/5.2
Toms Valley Creek-Elk Creek	3,598.4	2.1/2.1
Upper Canyon Creek	127.9	0/0
Upper East Fork Elk Creek	3,873.3	0/0
Upper Elk Creek	3,024.6	0/0
Upper Grider Creek	8,467.5	3.0/3.0
Walker Creek	7,592.7	4.2/4.0
West Grider Creek-Klamath River	991.0	4.5/1.1
Grand Total	131,313	119/76.8

Both the Whites Fire and Happy Camp Complex burned within the Lower Scott River. The Happy Camp Complex affected tributaries to the Scott River including 34,239 acres within the Canyon Creek watershed and 9,327 acres in the Tompkins Creek watershed. The Whites Fire burned 1,542 acres within the French Creek watershed. These streams provide important habitat for anadromous salmonids and other native species. The Lower Scott River Ecosystem Analysis (USFS 2000) and the Callahan Ecosystem Analysis (USFS 1997a) contain more detailed information on watershed conditions. For the Scott River, this discussion is focused on areas affected by the fires and that will have proposed activities: the mainstem Scott River from Kelsey Creek downstream, and Tompkins Creek.

Aquatic Resources

The Scott River provides habitat for fall-run Chinook, steelhead, Coho salmon, Pacific lamprey and other native species. Fall Chinook are usually not able to access historical spawning habitat in the upper mainstem Scott River or in the East Fork of South Fork Scott River due to low late summer/early fall flows. Juvenile Coho salmon have been observed in the South Fork Scott River, Boulder Creek, French Creek and Sugar Creeks.

In recent times, and especially since 2001, spawning and/or redds of Coho salmon have been observed in the mainstem Scott River and its tributaries, including: East Fork Scott River, South Fork Scott River, Sugar Creek, French Creek, Miners Creek, Etna Creek, Kidder Creek, Patterson Creek, Shackleford Creek, Mill Creek, Canyon Creek, Kelsey Creek, Tompkins Creek, and Scott Bar Mill Creek (Soil Conservation Service 1972, CDFG 1974, Maurer 2005, Yokel 2007-2011, Calfish 2013 *In* NMFS 2014).

The South Fork Scott River provides approximately 4.7 miles of habitat for anadromous salmonids. KNF stream surveys document that the upper extent of Coho spawning in the South Fork Scott River appears to be limited by a natural barrier in the gorge at mile 4.7.

Tompkins Creek is a third-order perennial of the Scott River. Flowing south, it drains the western flanks of Tom Martin Peak, the south side of Lake Mountain Peak, and much of the east side of the ridge south of Lake Mountain Peak to the Tyler Meadows area. Past and present influences within the drainage include timber harvests, roads, grazing, mining, water diversion, wildfire, and flood. Coho, steelhead, and rainbow trout are present in the creek, with the upstream limits of each species (e.g., approx. three miles upstream from the mouth of Tompkins Creek for SONCC Coho salmon) restricted by gradient, discharge, stream size, and/or barriers.

O'Neil Creek is a second-order perennial tributary to the Middle Klamath and drains the ridgeline between Tom Martin Peak and Lake Mountain Peak. O'Neil Creek provides habitat for rainbow trout, and Coho and Chinook salmon in the lower reaches near or downstream of Highway 96. Due to restoration at Highway 96, SONCC Coho salmon can now ascend O'Neil Creek above the bridge crossing, but suitable habitat is limited above here by progressively steepening gradients.

Elk Creek provides about 51.6 miles of fish-bearing streams and provides habitat for SONCC Coho salmon, Chinook salmon, steelhead, Pacific lamprey, Klamath smallscale sucker and other native fishes. Steelhead are found in the mainstem as well as Bear, Cougar and the East Fork of Elk Creek. Fall-run Chinook salmon are found in the lower 14 miles of Elk Creek. Coho salmon utilize habitat in mainstem Elk Creek and the lower section of East Fork Elk Creek up to Little Elk Creek.

Thompson, Walker and Grider creek watersheds provide spawning, rearing and holding habitat for fall and spring-run Chinook salmon, winter and summer run steelhead and Coho salmon. In addition, these streams provide habitat for Pacific lamprey and other native species. Based on stream survey data anadromous salmonids can access the lower reaches of Grider and West Grider creeks, and Walker Creek. The other smaller, steep, bedrock-dominated, stream systems found within these subwatersheds are generally more suited to resident trout populations than to anadromous species. However, these streams are critical as thermal refugia to anadromous populations because of the high quality, cool water they provide downstream to the Middle Klamath River system.

Grider Creek is a Key watershed and a domestic water source for private landowners. There are approximately 18.4 miles of fish-bearing streams in the Grider Creek watershed. Coho salmon are found in the lower 8.0 miles of the mainstem of Grider Creek. CH for Coho salmon is considered to be the same as steelhead, that is, the lower 12 miles of the mainstem of Grider Creek. There are no Coho salmon or CH in any of the tributaries to the mainstem of Grider Creek. Steelhead are found within approximately lower 12 miles of the mainstem. Fall-run Chinook salmon are found within the lower 7.5 miles of the mainstem of Grider Creek. Spring-run Chinook salmon are not known to be present in Grider Creek. There is no EFH for Coho salmon or Chinook salmon in any of the tributaries to the mainstem of Grider Creek. Resident trout occupy Rancheria, Fish, and Cliff Valley creeks.

Rancheria Creek is a third order stream that flows west draining the ridgeline south of Lake Mountain Peak to the Marble Mountain Wilderness boundary. This stream supports resident rainbow trout and steelhead in the lower reach, as there is a barrier to upstream salmonid migration about 0.5 miles upstream from the mouth.

Sediment

The Scott River is a 303(d) Clean Water Act listed reach (Sediment; Table 13). Excessive sediment loads and elevated water temperatures in the Scott River and its tributaries have resulted in degraded water quality conditions that impair anadromous fish production. Sediment yield from some Lower Scott River tributaries increased as a result of the 1997 flood and many reaches of the East Fork Scott, Moffett Creek and Shackleford Creek also suffered flood damage.

Sommerstrom (2001) measured fine sediment at many different locations on the mainstem Scott River and also on some tributaries. McNeil samples of fine sediment in the mainstem Scott showed sand size particles (<6.3 mm) to comprise more than 90% of the bed at some locations. Optimal levels of fine sediment of this size would be less than 20%. Sommerstrom (2001 noted that the principle source of fines was watersheds with granitic terrain and more specifically from road surfaces, road cuts and road fills. Following the sediment study, a French Creek Watershed Advisory Group was formed to help coordinate activities in this highly erodible Scott River sub-basin. The U.S. Forest Service, private timber landowners, ranchers, the County of Siskiyou and the Scott Valley CRMP (later to become the Scott Valley Watershed Coucil) all contributed to erosion control projects in French Creek. Studies to determine fine sediment in pools (V*) were conducted by the U.S. Forest Service in French Creek to determine the progress of restoration. The volume of fine sediment in pools decreased from approximately 30% in 1992 to nearer 10% in the following three years. The 1997 high water seemed to shift a great deal of fine sediment to reaches of the Scott River just above its convergence with the Klamath. These reaches are often the most important for spawning, particularly in drought years. However, the flows in fall of 1997 allowed fish access to reaches further upstream that had lower levels of fine sediment. Sediment yield increased in Lower Scott River tributaries on USFS lands as a result of the January 1997 storm event. The U.S. Forest Service repaired some of the flood damage to roads and other infrastructure from the 1997 storms. The most intensive area of activity for road repair after the 1997 flood was in the Canyon Creek, Kelsey Creek, and Tompkins Creek watersheds. The Klamath National Forest improved drainage structures and stream crossings in these watersheds so that future flood damage is much less likely. Even during moderate flows, Moffett Creek has such high turbidity levels that it discolors the Scott River down to its convergence with the Klamath.

Altered sediment supply occurring in the Scott River imposes a medium stress to juvenile and smolt, high stress to adults, and a very high stress to the egg and fry Coho salmon life history stages (NMFS 2014). The movement of fine sediment into streams can cause substrate embeddedness, preventing spawning and smothering eggs in redds. Additionally, excessive levels of fine sediment in pools and low gradient reaches of the Scott River and its tributaries also reduce the amount of rearing habitat available for juvenile Coho salmon (USFS 2000, NCRWQCB 2006, CDFG 2009, Cramer Fish Sciences et al. 2010 *In* NMFS 2014). While unaltered background levels of sediment

were around 10 percent volumetrically, monitoring in the French Creek watershed has shown large fluctuations in the percentages of fine sediment occurring in this watershed (Sommarstrom et al. 2001). Data from the early 1990s indicate a high of approximately 32 percent fine sediment occurring in French Creek in 1992, decreasing to approximately 7.5 percent by 1994 (Power and Hilton 2003), and then reaching a dynamic level of approximately 14 percent in 2012 (Farber and Nicolls 2012). More recent monitoring indicates that there is still a large percentage of fine sediment in the channel substrate in the upper portions of French Creek, which is one of the two most productive spawning and rearing tributaries in the Scott River basin.

Tompkins Creek is considered to be "At Risk" for sediment. A 2011 survey documented elevated fines in pools and substrates relative to reference conditions (USFS 2013). Erosion of streambanks was identified as a primary source of sediment and is a result of past flooding.

The Lower Scott River 5th-field watershed post-fire ERA risk ratios are at 0.48, well below 1.0, and indicating that disturbance resulting from roads, vegetation management, and wildfire is sufficiently below the watershed TOC. This is interpreted to mean that effects on increased peak flow will not be significant at this scale. However, channel change would be expected along reaches that convey debris flows. The Lower Scott post-fire Mass Wasting (GEO) risk ratio is at 0.6, below the TOC and indicates increased hillslope sediment production is not expected to be significant at this scale.

Elk Creek is characterized by having good water quality and serves as a domestic water supply for Happy Camp. Except for broad, coarse alluvial deposits in Elk Creek upstream from its confluence with East Fork Elk, little sediment is stored in stream channels. Most of the coarse sediment in stream channels is delivered by landsliding. Streams in the Elk Creek basin are high gradient, coarse bedded and erosion dominated. Channels run through steep, narrow gorges. This watershed was extensively burned in 1987 and subsequently salvage logged. The January 1, 1997 storm initiated debris torrents at the headwaters of Elk Creek and major channel changes occurred to over 80% of the channel of Elk Creek (De La Fuente 1998). Significant quantities of big wood were entrained by floodwaters and major bed aggradation also occurred.

In 2014, the Happy Camp Complex Fire burned 34,633 acres in the Elk Creek watershed. KNF BAER teams reported that many of the intermittent and ephemeral channels in the affected watersheds are full of sediment and that a significant storm event will mobilize this sediment and send it downstream to perennial streams. BAER teams predicted that the primary watershed responses are expected to include: 1) an initial flush of ash, 2) rill and gully erosion in drainages and on steep slopes within the burned area, and 3) flash floods with increase peak flows and sediment deposition. The BAER teams expected that these responses would be greatest within initial storm events. Field observations after the first larger rain event in November 2014 confirmed that there was an initial flush of sediment and ash. The disturbances will become less evident as vegetation is reestablished, providing ground cover and increasing surface roughness. Soils will also become stabilized and the infiltration capacity of the soils will improve.

The Elk Creek 5th-field watershed ERA risk ratios are at 0.5, well below 1.0 indicating that disturbance resulting from road, vegetation management, and wildfire is sufficiently below the watershed threshold of concern (TOC), and interpreted to mean that effects on

increased peak flow will not be significant at this scale. However, channel change would be expected along reaches that conveyed debris flows. At the HUC 7 scale, Middle Elk Creek watershed exceeds the TOC based on post-fire ERA modelling. Middle Elk Creek HUC 7 also exceeds the Mass Wasting (GEO) threshold of concern indicating a risk for increased hillslope sediment production.

Fire intensity and extent burned within RRs are also an indicator for potential sedimentation to streams and adverse effects to riparian function. Sediment impacts are likely to be minor to moderate because of the relatively low amounts (0.2-0.8%) of intermittent and perennial RRs burned at high severity. These high burn severity areas experienced a nearly complete loss of soil cover. Where this occurred, the magnitude of impacts would be strongly influenced by the severity of winter storms immediately following the fire and prior to re-establishment of grasses, forbes and shrubs. The duration of impacts would be likely to be intermediate between short- and long-duration as regrowth of vegetation reduces sediment source areas and high gradient channels flush stored sediments, dependent on the magnitude of winter runoff.

Thompson, Walker and Grider creeks are high-gradient, coarse-bedded and, due to uplift of the region, erosion dominated. Channels typically run in steep, narrow gorges. Although influenced by large landslides and bedrock structure and composition, channel patterns are dendritic. Except for broad, coarse alluvial deposits in the vicinity of the mouth of Seiad and Grider Creeks, relatively little sediment is stored in stream channels. Channels are typically cut in bedrock. Most of the coarse sediment generated to stream channels is delivered by landsliding. Fine sediment is generated by surface erosion of disturbed areas, as well as landsliding. Conditions within these watersheds are influenced by various watershed disturbances in combination with a large percentage of unstable or easily eroded land types. Large portions of these watershed were impacted by wildfires in 1987 and the January, 1997 flood event, which contributed large amounts of sediment to streams, especially to Walker Creek. Large amounts of coarse sediment were deposited at the mouth of Thompson, Seiad and Walker Creeks as a result of the 1997 flood event. These deposits occur as a result of channel widening where the streams enter the broad Klamath River channel. Such deposits cause wandering of the stream channels and channel-bank erosion. Some areas have received extensive timber harvest and have high road densities. The land types of the watershed include easily eroded granitic soils and both dormant and active landslides.

In the Thompson Creek, China Creek, and upper Walker Creek basins, extensive deposits of the Dormant Landslide and Residual Soil Terrane exist, and many large, active earthflow landslides are found in this terrane. Movement of some of the landslides that produced large quantities of sediment to these streams in the Flood of 1997 is associated with roads. Extensive Granitic Terrane is found in Grider and Walker Creek basins. Some of the sandy, low cohesion soils that form on granitic rocks make road fill that is difficult to stabilize. Refer to the KNF (1999b) Thompson/Seiad/Grider Ecosystem Analysis for more detailed information on watershed disturbance. Watershed impacts include high road densities, wildfires and past timber harvest. From 1922-1997, this area has had a total of 1,026 fires, 67% started by lightning. Extensive areas in these watersheds have been burned in past fires including as recent as 1987, which increased susceptibility to erosion. In the twelve years since these fires, ground fuels have increased. Road erosion

in these watersheds is triggered by intense seasonal thunderstorms, however severe erosion problems associated with roads may be chronic, and generally can be traced to one or more causes (e.g. geometric design of the road, road grades, surface type, soil type, road location, steepness of terrain, inadequate drainage structures, road location, lack of maintenance, or vehicle use during wet weather conditions). In addition, numerous road failures occurred in the Rancheria Creek sub-basin which had been logged. The rain-on-snow event in January 1997 triggered over 63 landslides and 15 road failures. The lowest reaches of Grider Creek widened substantially and water temperatures increased.

Water quality monitoring conducted by the Forest Service documented that Walker Creek V* values (pre-2014 fires) exceed reference conditions. A cause of impairment has been attributed to legacy sediment sites from past management.

KNF BAER teams documented conditions in these watersheds after the 2014 fires. Fire intensities in Grider Creek were as follows: 60% low; 30% moderate and 1.2% high (9% unburned). Fire intensities in Walker Creek were as follows: 58% low; 27% moderate and 3% high (11% unburned). The Happy Camp Complex BAER Hydrologic Response Report (USDA-KNF 2014) contains more detailed information on these and other watersheds in the burn area. Post-fire, hydrologists noted that many of the intermittent and ephemeral channels in the affected watersheds in the Happy Camp Complex fire area were full of sediment. A significant storm event was expected to mobilize this sediment and send it downstream including to Tompkins, Walker, Grider, and East Fork Elk Creek.

Thompson Creek-Klamath River post-fire 5th -field watershed risk ratios are at 0.3, well below 1.0 indicating that disturbance resulting from road, vegetation management, and wildfire is sufficiently below the watershed TOC, and interpreted to mean that effects on increased peak flow will not be significant at this scale. However, channel change would be expected along reaches that conveyed debris flows. The Walker Creek HUC 7 watershed exceeds the TOC based on post-fire ERA modelling. Risk ratios are at 1.03 indicating increased susceptibility for significant adverse effects. The Walker Creek 7th field watershed post-fire Mass Wasting (GEO) risk ratio is at 1.89, exceeding the Mass Wasting (GEO) threshold of concern and indicating a risk for increased hillslope sediment production. The Lower Grider Creek 7th field watershed risk ratio does not exceed TOC. The Lower Grider Creek 7th field watershed post-fire Mass Wasting (GEO) risk ratio is at 1.09, exceeding the Mass Wasting (GEO) threshold of concern and indicating a risk for increased hillslope sediment production.

KNF fisheries biologists conducted Chinook salmon spawning surveys post-fire and observed large quantities of post-fire sediment in the mainstem Grider Creek (Figure 1).

Figure 8. Post-fire sediment slug in Grider Creek.

Water Quality

Anthropogenic processes that influence water temperature include changes to: stream shade, stream flow via changes in groundwater accretion/reduction, stream flow via surface water use, microclimate, and channel geometry. The primary factor affecting stream temperatures in the Scott River watershed is increased solar radiation resulting from reductions of shade provided by near-stream vegetation. Changes in groundwater accretion also impact water temperatures in Scott Valley. Diversions of surface water lead to relatively small temperature impacts in the mainstem Scott River, but have the potential to affect temperatures in smaller tributaries where the volume of water diverted is relatively large compared to the total stream flow. Microclimate alterations resulting from near-stream vegetation removal increase temperatures, where microclimates exist. Changes in channel geometry from natural conditions may also negatively affect water temperatures.

Water temperatures in the Scott River can be limiting for salmonids, particularly in dry years. Flow depletion tends to contribute to temperature problems. Comprehensive temperature monitoring on the Scott and its tributaries has provided a greater understanding of how varying water years can affect temperature. The Scott River can exceed stressful conditions for salmonids in low gradient valley reaches in dry years, but remains below stressful on average in wet years. The warmest reaches of the Scott mainstem in the valley are at Highway 3 and Jones Beach. The Lower Scott River flows in a gorge which is completely open to the full arc of the summer sun and very subject to warming. Cold water tributaries flowing from USFS lands in the Marble Mountains moderate mainstem Scott River temperatures in this reach and provide substantialthermal refugia at their mouths. Channel scour in other Lower Scott River tributaries may also contribute to temperature increases. Loss of cold water contributions from these lower tributaries may have profound impact on ecosystem function in the Lower Scott River. Long-term trends show that periods of critically low flow have tended to increase since 1942, when flow records began to be monitored consistently on the Scott River.

Where passage is possible, juvenile fish can reach thermal refugia pools along both the mainstem Scott River and west-side tributaries, where the water temperature can be

several degrees cooler than in adjacent channels. NMFS (2014) lists the following areas as thermal refugia: French Creek, Patterson Creek, Kidder Creek, Shakleford/Mill Creek, Scott River from Boulder Creek to Tompkins Creek, Canyon Creek, Kelsey Creek and Tompkins Creek.

The WSFR Project is within the Lower Scott River 5th-field watershed, which includes the mainstem from the mouth to about one mile east of Jones Beach or Isinglass Creek area, and all the subwatersheds and other land areas that drain to this section of mainstem. While the mainstem Scott River stream temperatures are "not properly functioning", French, Tomkins and Canyon creeks are all considered "Properly Functioning" relative to stream temperatures (see Table 13) and provide important thermal input and refugia to aquatic species in this watershed.

Table H-22. 2013 water temperature data for Lower Scott River (USFS 2014h).

Location	Date of Maximum MWMT	Maximum Weekly Maximum Temperature ºC (MWMT)
Scott River at Sugarpine Gulch	7/26/13	26.6
Scott River downstream of Bridge Flat CG	7/27/13	23.7
Scott R downstream from Townsends GL	7/27/13	24.6
Scott River near 7F01Bridge	7/26/13	27.9
French Creek upstream of NF French Creek	7/26/13	19.7
Tompkins Creek at USFS property line Sec. 3	7/27/13	17.4
Canyon Creek (Scott) just upstream from mouth	7/27/13	16.3

Figure 9. Burned RR in Grider Creek, fall 2014.

The percent of streamside areas that burned in the 2014 fires is an indication of impacts to riparian function, including stream shade along perennial streams. Approximately 0.2% of perennial streamside areas burned at high severity and will provide little to no shade post-fire and until trees re-establish. Approximately 11% of perennial streamside areas burned at moderate severity and, based on field observations, experienced an estimated 50% loss of vegetation. The percent of impact from 2014 Happy Camp Complex fires to streamside areas is relatively low, and is not expected to result in measurable changes to stream temperatures.

Table H-23. Summary of stream channel burn severity data from BAER reports (USFS 2014a-2014f) for the 2014 Happy Camp Complex.

Fire Area	Stream Type	Very Low miles (%)	Low Miles (%)	Moderate miles (%)	High miles (%)	Total (miles)
Happy Camp Complex	Intermittent	23 (9%)	196 (72%)	50 (18%)	2 (0.8%)	271
	Perennial	31 (13%)	188 (76%)	27 (11%)	0.4 (0.2%)	246

Peak summer temperatures have been higher than optimal for fish in the lower mainstem reaches of Elk Creek. However, habitat in Elk Creek provides some of the highest quality spawning and rearing habitat for Coho salmon in the Middle Klamath River (Mid Klamath Restoration Partnership 2010) and Elk Creek is considered thermal refugia (MKWC 2006, NCRWQCB 2010). Recent temperature monitoring data collected by the KNF indicates that Elk Creek stream temperatures range from “Properly Functioning” to “At Risk.”

Table H-24. 2013 water temperature data for Elk Creek (USFS 2014h).

Location	Date of Maximum MWMT	Maximum Weekly Maximum Temperature ºC (MWMT)
Elk Creek at 7C001 Bridge	7/27/13	23.0
Elk Creek upstream of mouth ~0.5 mile	7/27/13	23.2
Elk Creek upstream of Bear Creek	7/27/13	20.5
East Fork Elk Creek upstream from mouth	7/27/13	20.0

Thompson, Walker and Grider creeks are rainfall dominated. Streamflows and the maintenance of cool water during the hot dry season are sustained primarily by groundwater inputs. Large areas of dormant landslide terrain, typically composed of deep red soils, function as a sponge in storing and slowly releasing large quantities of water. Most of the subwatersheds generally have streams that flow dependably all year long, with relatively high baseflows and good water quality. Most named creeks support fish in their lower reaches before the channel gradient gets too high and upstream passage becomes restricted by waterfalls or debris jams in constricted channels.

The mouth of Grider Creek formerly produced one of the most important large, cold water refuge areas on the mainstem Klamath (Belchik and Turo, 2002), but the flood effects of the 1997 storm raised temperatures and reduced the benefit of this area as a refugia. However, Grider Creek provides CH for Coho salmon and stream temperatures are rated as “Properly Functioning” relative to salmonid criteria.

Walker Creek suffered the worst flood damage in 1997 of any stream on the KNF and its stream channel and floodplains were scoured from headwaters to the mouth. One reach of Walker Creek went from approximately 50 feet wide to over 200 feet wide. It will be decades before this tributary recovers. It had provided a medium sized refuge area of cold water at its convergence with the Klamath according (Belchik and Turo, 2002). Walker, Grider and Thompson creeks provide important water quality to the Middle Klamath River and these tributaries may provide thermal refugia for anadromous salmonids during warm periods.

Table H-25. 2013 water temperature data for Walker, Grider, and Thompson creeks (USFS 2014h).

Location	Date of Maximum MWMT	Maximum Weekly Maximum Temperature ºC (MWMT)
Grider Creek near 46N66 Bridge	7/27/13	19.1
Walker Creek at ~RM 1.1	7/27/13	18.9
Thompson Creek near 18N02 Bridge	7/27/13	17.3
Thompson Creek upstream from Cedar Creek	7/30/13	15.4

Riparian Function

The Lower Scott River flows through a canyon with intermediate gradient and faster current, when there is sufficient flows. A majority of the Lower Scott River basin is USFS lands and the mid- and upper valley portions are mostly privately owned.

The 2014 fires had no effect on instream wood levels in the mainstem Scott River but will affect short-term wood loading, and large wood available for recruitment in the long-term. Fire intensity and extent of area burned within RRs is used herein as to update available large wood information collected prior to the 2014 fires. High burn severity areas along perennial streams will experience an increase in wood loading in the short-term and a reduction in large wood available for recruitment to streams in the long-term. The percent of perennial stream channels that burned at high severity during the 2014 fires is limited (<0.2 percent), indicating that fire effects to the large wood loading and recruitment baseline were insignificant. Approximately 11% of perennial stream RRs were burned at moderate severity in the Happy Camp Complex, and an estimated 50 percent of the vegetation was burned in these areas. Thus, in the moderate severity areas, an increase in large wood loading is expected in the near term, and a reduction in large wood available for recruitment is expected in the long-term. Collectively, these high and moderate burn severity areas will increase large wood loading in the near term and reduce the available sources of large wood recruitment in the long-term.

The Happy Camp Complex burned approximately 34,633 acres within the Elk Creek watershed. Elk Creek is a tributary of the Klamath River and a “Key” watershed. Its’ confluence with the Klamath River is just downstream of the town of Happy Camp. Over 99% of the lands in the Elk Creek watershed are federal lands. The Elk Creek Ecosystem Analysis contains more detailed watershed information (USFS 1995d).

The Happy Camp Complex burned 11,243 acres in the Thompson Creek-Klamath River 5th-field watershed, 7,593 acres in the Walker Creek watershed, and 20,223 acres in the Grider Creek watershed. Walker and Grider creeks are included here because they are important 6th-field Klamath River tributaries that provide habitat, including non-natal rearing habitat, for anadromous salmonids and other native species, and have proposed Project activities. For more detailed information on these watersheds see the Thompson/Seiad/Grider Ecosystem Analysis (USFS 1999).

RRs in the Elk Creek basin are predominately forested and comprised of conifers and hardwoods. Current levels of large woody debris are considered “at risk”. Large wood was removed from Elk Creek in the 1960s and 1970s to prevent damage to downstream infrastructure and floods have since removed shallow-rooted vegetation, such as alders, in patches immediately adjacent to the mainstem. Large wood is delivered to stream channels via debris flows in Elk Creek. The Elk Creek Mass Wasting Risk Ration is at 0.98, bumping up against the Mass Wasting (GEO) threshold of concern, indicating an

increasing risk for debris flows, which would increase large wood loading to streams as well as sedimentation. Debris slides and floodwaters from the 1997 storms contributed large wood, which subsequently added to habitat complexity in Lower Elk Creek.

The 2014 fires had no effect on instream wood levels in the mainstem Elk Creek but will increase wood loading in the near-term, and reduce large wood available for recruitment in burned areas in the long-term. Fire intensity and extent of area burned within RRs is used here to update available large wood information collected prior to the 2014 fires. High burn severity areas along perennial streams will experience an increase in wood loading in the short-term and a reduction in large wood available for recruitment to streams in the long-term. The percent of perennial stream channels that burned during the 2014 firees at high severity is limited (<0.2 percent) indicating that effects to large wood loading and recruitment will be minor. Approximately 11% of perennial stream RRs were burned at moderate severity in the Happy Camp Complex, and an estimated 50 percent of the vegetation was burned in these areas. Thus, in the moderate severity areas, an increase in large wood loading is expected in the near term, and a reduction in large wood available for recruitment is expected in the long-term.

The Whites Fire Project Area

The Whites Fire burned a total of 38,916 acres in the North Fork Salmon River. Amount of burned area, and total miles of CH, within the 7th field watersheds of the Whites Fire are shown in Table 26. USFS ecosystem analyses (USFS 1995b; USFS1995c; USFS 1997b and c) contain more detailed watershed information. Current environmental baseline information for habitat indicators in fish-bearing 7th field watersheds is provided in Appendix D.

Table H-26. Whites Fire 7th field watersheds, burned acres and miles of Coho CH.

Whites Fire HUC 7 Watersheds	Whites Fire Burned Acres	Total Miles of Anadromous Salmonid Habitat/Miles Within the Analysis Area	Total Miles of Fish-Bearing Streams/Miles of Habitat Within the Analysis Area
Big Creek	104.2	1.1/0	1.1/0
Eddy Gulch	178.3	2.7/0.2	2.7/0.2
Jackass Gulch	384.3	2.5/0	2.8/0
Jessups Gulch-North Fork Salmon River	328.2	2.6/0.2	2.6/0.2
Lower North Russian Creek	4,501.2	4.6/4.6	4.7/4.7
Lower South Russian Creek	2,137.9	2.1/2.1	2.2/2.2
Music Creek	3,285.8	0	0
Robinson Gulch-North Fork Salmon River	5,038.0	4.6/4.6	4.6/4.6
Shadow Creek	693.7	1.9/0	1.9/0
Sixmile Creek	885.9		2.5/0
Specimen Creek	164.1	2.2/0	3.2/0
Sugar Creek	234.6	4.0/0	9.2/0
Taylor Creek	2,973.2	0/0	0/0
Upper French Creek	1,307.8	8.5/0	15./0.5
Upper North Russian Creek	1,346.8	1.2/1.1	1.2/1.1
Upper South Russian Creek	5,142.4	1.0/1.0	8.0/5.9

Whites Fire HUC 7 Watersheds	Whites Fire Burned Acres	Total Miles of Anadromous Salmonid Habitat/Miles Within the Analysis Area	Total Miles of Fish-Bearing Streams/Miles of Habitat Within the Analysis Area
Whites Gulch	8,308.2	1.6/1.6	3.6/3.6
Yellow Dog Creek-North Fork Salmon River	5,023.1	6.0/3.5	6.1/3.5
Grand Total	**42,037.9**	**46.6/18.9**	**71.4/26.5**

Aquatic Resources

The Salmon River is a Key Watershed. This basin provides approximately 175 miles of anadromous fish habitat (Elder et al. 2002), distributed within the main stem, Wooley Creek, and North Fork and South Fork Salmon River, including for spring and fall run UKT Chinook salmon, summer and winter run KMP steelhead, and SONCC Coho salmon.

The Salmon River spring-run Chinook salmon are one of the last and largest populations in the Klamath River system (Elder et al. 2002). Spring Chinook use the mainstem Salmon River, Nordheimer Creek, and Wooley Creek (Brucker 2004 *In* NCRWQCB 2005; Barnhart 1994, USFS 1995c, West 1991) and apparently use the mainstem North Fork up to the confluence with Right Hand Fork, as well as the Little North Fork and South Russian Creek (Brucker 2004, USFS 1995c). Spring Chinook use the South Fork mainstem at least to the Little South Fork and to Shadow Creek in the East Fork of the South Fork, as well as several tributaries, particularly Knownothing Creek and Methodist Creek (Brucker 2004, Elder et al. 2002, USFS 1997c).

Fall Chinook use much of the same habitat (except for holding) as the spring Chinook, though generally do not go as far up the streams. Barnhart (1994) stated that fall Chinook use in the mainstem, North Fork, and South Fork, and Moyle (2002) indicated Wooley Creek as a spawning stream as well. Use in the North Fork occurs at least up to Russian Creek USFS (1995c), and in the South Fork up to French Creek (Barnhart 1994). Spawning occurs in Nordheimer Creek, a mainstem tributary, as well as in a number of tributaries to the South and North forks. Brucker (2004) reports observations of late fall/winter run Chinook in the Lower Salmon River watershed below Knownothing Creek.

Steelhead are the most widely distributed of anadromous salmonids in the Salmon River system (Elder, et al 2002). Summer steelhead adults use summer holding areas with spring Chinook. Snorkel counts of summer steelhead indicate about 50% hold in the South Fork, the remainder split equally between Wooley Creek, the North Fork and the mainstem (USFS 1997b).

The North Fork Salmon River (5th-field watershed) is one of two major forks of the Salmon River and is part of the National Wild and Scenic River System. The North Fork Salmon River provides habitat for the Klamath River's largest wild run of spring Chinook, as well as KMP summer-run steelhead. These wild Salmon River runs are unaffected by hatchery-produced salmonids because there are no fish hatcheries in the Salmon River basin. Coho and Chinook are present in the North Fork Salmon River. Spawning and dive surveys document spring- and fall-run Chinook and summer steelhead.

A comprehensive review of datasets originating from multiple agencies/entities was conducted by CDFW, with the conclusion that Coho presence in the North Fork Salmon River has been substantiated (Garwood 2012). Coho spawning surveys in the North Fork Salmon River are not conducted due to dangerous discharge conditions and poor water visibility, therefore observations of rearing juveniles during summer and fall is used to indicate Coho presence. A 2005 survey of thermal refugia in the North Fork Salmon River found Coho juveniles at the mouth of the following tributaries: Big Creek, Olsen Gulch, Jones Gulch, Little North Fork Salmon River, Shiltos Creek, and Jackass Gulch (SRRC 2005). Coho, Chinook and steelhead presence in Big Creek is expected to be limited to the mouth area only due to the small size of this drainage, low discharge, steep gradient, and lack of adequate spawning substrate. The culvert, just above the mouth of Big Creek, is considered to be a barrier to anadromous fish. Coho or Chinook surveys have not been conducted in Jackass Gulch; suitability of the system for these species is unknown. Spawning surveys were performed in 1991 and 1999, but no live fish, carcasses, or redds were found. The upstream limit of anadromy is considered to be a waterfall located ~0.2 miles above the mouth. This barrier was noted by KNF biologists in 1975, 1983, and 1988. The falls were modified in 1990 by the installation of two log and rock weirs to allow steelhead access to upstream habitat, however, the structures are no longer functioning as designed. No surveys specifically targeting Coho or Chinook salmon have been completed in the Specimen Creek drainage. This situation is largely due to difficulty of road access and/or unsafe discharge conditions when Coho would be expected to be spawning. Habitat surveys which included snorkeling to identify fish occurred in 1991, but did not observe Coho. Resident rainbow trout and presumed steelhead juveniles have been observed in the mainstem Specimen Creek to 1.5 miles up from the mouth, with resident trout present for an additional mile upstream; and both are found on Left Hand Fork to a distance of 0.75 miles up from the mouth. Fish (fry) have also been recorded as present in the King Creek tributary to a distance of ~1000 feet. Additionally, spawning surveys conducted in 1981, 1988, 1990-1996, and 1999 were positive all years, except 1993, for live steelhead and redds. Although Garwood (2012) stated Coho occupancy in Specimen Creek to be unsubstantiated, this conclusion was based from limited records. The 1995 Klamath National Forest North Fork watershed analysis did identify Specimen Creek as potentially supporting Coho salmon (USFS 1995).

Sediment

In addition to fire effects, landsliding is a significant watershed process of concern in the North Fork Salmon River. Roads and harvest in granitic soils, road density, and fire are concerns relative to increasing landslide potential in this watershed. During the Twentieth Century, 75 percent of the landslide-derived sediment, which entered the stream, was associated with flood and storm events that occurred from 1964 to 1975. Roads produced landslides at a rate much higher than undisturbed lands. Harvested or burned areas produced landslides at a rate much lower than roads but higher than undisturbed lands.

The 2014 wildfires affected tributaries to the North Fork Salmon River that provide habitat for anadromous salmonids (Cow Creek, North Russian, South Russian and Whites Gulch) as well as tributaries that provide habitat for resident steelhead trout (Highland Creek, Hogan Creek, Johns Meadows Creek, Music Creek, Sawmill Gulch and Taylor

Creek). Several other small, unnamed drainages that drain the east side of Tanners Peak towards the North Fork Salmon River between Idlewild Campground and Mule Bridge were also burned but do not have connectivity to the North Fork Salmon. Redd mapping (2011 through 2013) has documented Chinook redds scattered throughout anadromous streams in the 2014 fire-affected area. Although fire and its effects are a part of the natural disturbance regime in a watershed, a primary concern is the potential for excessive fine sediment, which can result in pool filling, impacts to spawning substrate, food production and thermal refugia. Several accessible tributaries to the North Fork Salmon River within the wildfire area function as thermal refugia when the mainstem North Fork Salmon River temperatures increase. The extent of damage to RRs and the potential for impacts to stream shade is also a concern.

Post-fire BAER field reviews were focused on identifying the necessary treatments to minimize both road failure and general mobilization of post-fire road-related sediment, such as installation of critical dips and cleaning of culverts and cross-drains. Treatments were identified for Whites Gulch as multiple culverts were found to be partially blocked with debris, with a few completely buried such that the inlet could not be found. Post-fire mapping indicated that burn intensity along fish-bearing streams was predominantly low, or unburned. The primary exception was East Fork Whites Gulch, as well as a small segment of the North Fork Salmon River in the Hickey/Applesauce Gulch area. Additionally, the riparian area of many of the larger fishless perennial streams within the fire boundary exhibit relatively low burn severity. Field observation confirmed mapping results.

Table H-27. Summary of watershed burn severity for 2014 Whites Fire.

Fire Area	Amount of Very Low Acres (%)	Amount of Low Acres (%)	Amount of Moderate Acres (%)	Amount of High Acres (%)	Total (Acres)
Whites Fire	5,612 (17%)	16,497 (49%)	10,007 (30%)	1,637 (5%)	33,753

The North Fork Salmon River post-fire 5th-field watershed risk ratio is at 0.33, well below 1 indicating that disturbance resulting from road, vegetation management, and wildfire is sufficiently below the watershed TOC, and interpreted to mean that effects on increased peak flow will not be significant at this scale. However, channel change would be expected along streams/reaches that conveyed debris flows. The North Fork Salmon River 5th-field watershed post-fire Mass Wasting (GEO) risk ratio is at 0.73 and does not exceed the Mass Wasting (GEO) threshold of concern.

Table H-28. Modeled post-fire CWE, USLE, and Mass Wasting (GEO) risk ratios for Whites Fire 5th field watersheds.

5th-field Watershed	Area (Acres)	Pre-Fire (2012)	Post-Fire, No Action	2014 Fire Area
ERA Risk Ratios				
North Fork Salmon River	130,545	0.17	0.34	Whites Fire
USLE Risk Ratios				
North Fork Salmon River	130,545	0.05	0.33	Whites Fire

5th-field Watershed	Area (Acres)	Pre-Fire (2012)	Post-Fire, No Action	2014 Fire Area
GEO Risk Ratios				
North Fork Salmon River	130,545	0.53	0.73	Whites Fire

Water Quality

The Salmon River is impaired and is listed under the 303(d) Clean Water Act for temperature (Table 13). Water temperatures stressful to salmonids occur in the Lower Salmon River annually, but the extent and duration changes in different flow years. Cool, deep pools in the Lower Salmon River are critical for summer holding and rearing salmonids. Spawning occurs in the mainstem Salmon River in gravels located in pool tail-outs.

Shade is lacking along the entire North Fork of the Salmon, with the exception of the upper-most reaches. Tributary temperatures are typically below lethal levels and provide thermal refugia. The Little North Fork has the largest cooling effect on the North Fork of the Salmon River due to its significant flow contribution. High water temperatures have resulted in fish kills of spring-run Chinook salmon and summer steelhead during warm low-flow drought conditions of some summer seasons, such as in 1994 and 2014.

The KNF collected water temperature data in 2013 (Table 29). Temperatures ranged from “properly functioning” to “at risk” to “not properly functioning.”

Table H-29. 2013 water temperature data for NF Salmon River (USFS 2014h).

Location	Date of Maximum MWMT	Maximum Weekly Maximum Temperature ºC (MWMT)
NF Salmon River upstream of Mule Bridge	7/27/13	21.9
NF Salmon River upstream of Right Hand Fork	7/27/13	19.5
NF Salmon River just upstream of Forks	7/27/13	26.2
NF Salmon R upstream of Little NF	7/30/13	25.6

The percent of stream channel burned in 2014 is an indication of the impacts to riparian function, including stream shade along perennial streams. Approximately 3% of streamside areas were burned at high severity and these areas will provide little to no shade to stream channels post-fire until trees re-establish. Approximately 14% of streamside areas burned at moderate severity, and these areas experienced an estimated 50% reduction in streamside vegetation. The relative percentages of reduction in vegetation along streams is low, and are not expected to measurably increase stream temperatures.

Table H-30. Summary of stream channel burn severity data from BAER reports (USFS 2014a-2014f) for the 2014 Whites Fire.

Fire Area	Stream Type	Very Low Severity Miles (%)	Low Severity Miles (%)	Moderate Severity Miles (%)	High Severity Miles (%)	Total (miles)

Fire Area	Stream Type	Very Low Severity Miles (%)	Low Severity Miles (%)	Moderate Severity Miles (%)	High Severity Miles (%)	Total (miles)
Whites Fire	Intermittent	18 (21%)	43 (50%)	21 (24%)	4 (5%)	86
	Perennial	16 (25%)	36 (57%)	9 (14%)	2 (3%)	63

Riparian Function

Approximately 29 percent of the watershed is designated as RRs, which includes unstable or potentially unstable lands and stream buffers. Current conditions in RRs have been impacted by historic grazing, roads, stream crossings, and mining. Analysis of the 1944 air photos showed that at that time, most stream channels were fully vegetated with a mixture of conifer and hardwood species. The 1964 flood resulted in major changes to the stream channel in that the channel widened and long segments were scoured out. The entire length of the North Fork of the Salmon River was modified and stripped of riparian vegetation. For context, there were 8 miles of freshly scoured channels visible on the 1944 air photos, 40 miles of freshly scoured channels on the 1965 photos, and 12 miles of freshly scoured channels on the 1975 photos. Recovery from debris and other scour events occur in stages and along variable timelines. Full recovery of large conifers may take 100 years or more, although initial recovery of short-lived riparian species that also provide bank stability and integrity can occur in a decade or two. In 1995 the Klamath National Forest estimated that the mainstem North Fork of the Salmon River showed 20 percent initial recovery since the 1964 flood. This may be because, in general, larger streams recover more slowly than smaller streams (the KNF also studied recovery of smaller streams) due to larger surface areas affected by scour and larger streamflows acting on this surface. Unstable areas and disturbed streams that have poorly defined primary channels may recover slowly due to frequent re-disturbance by subsequent high flow events.

Significant portions of RRs were burned in the past with moderate to high severity by the Hog, Yellow, and Specimen fires. Riparian vegetation recovery to a mature state within granitic terrains takes approximately 80 years (to re-establish large conifers). As described above, post-2014 fire mapping indicated that burn intensity along fish-bearing streams was predominantly low, or unburned. The primary exception was East Fork Whites Gulch, as well as a small segment of the North Fork Salmon River in the Hickey/Applesauce Gulch area. Additionally, the riparian area of many of the larger fishless perennial streams within the fire boundary exhibit relatively low burn severity. Field observation confirmed mapping results.

The 2014 fires had no effect on instream wood levels in the mainstem but will affect tributaries that burned relative to short-term wood loading and large wood available for recruitment in the long-term. Fire intensity and extent of area burned within RRs is used herein to update the large wood information collected prior to the 2014 fires. High burn severity areas along perennial streams will experience an increase in wood loading in the short-term and a reduction in large wood available for recruitment to streams in the long-term. The percent of perennial stream channels that burned in the Whites Fire at high severity is limited (3%) indicating that effects to large wood loading and recruitment will be minor. Approximately 14% of perennial stream RRs were burned at moderate severity in the Whites Fire, and an estimated 50 percent of the vegetation was burned in these

areas. Collectively, these high and moderate burn severity areas will increase large wood loading in the near term and reduce the available sources of large wood available for recruitment in the long-term.

VII. Effects of the Action

The following effects analysis is based upon project data as of 03/31/15. Since that date, field review has continued to provide information that leads to minor modifications in project design such as trimming or dropping of treatment units based on feasibility or economic (cost/benefit) considerations; or changes to logging systems and temporary roads and landings. During this consultation process, potential changes to the following roads were discussed: roads 46N78, 46N41YA, 15N75A, 40N61A and 46N30Y. The potential changes to project design for these roads would reduce potential impacts to riparian/aquatic resources including SONCC Coho salmon and CH (roads may be dropped prior to decision and not used in the Project). The analysis presented in this biological assessment, however, includes actions on these roads as described herein and displayed on maps in Appendix A.

Direct Effects

The potential for direct effects to Coho salmon and anadromous salmonid habitat is associated with actions that occur within active stream channels. The only PEs proposed within active stream channels are water drafting and road stream crossing work, the latter related to both temporary road use and Legacy sediment site restoration.

Water Drafting. Direct effects to Coho salmon and anadromous salmonid habitat can result from water drafting activities. Numerous water drafting sites may be used for the WSFR Project, and some are within Coho salmon CH (see locations in Appendix A).

Drafting operations can disturb holding or spawning adult fish, as well as impinge or entrain juveniles (Sicking 2003). Additionally, water drafting operations can mobilize suspended sediment to nearby downstream aquatic habitat. Suspended sediment increases turbidity, exposing juvenile fish to gill damage and reduced oxygen uptake, and/or reduced vision and compromised feeding effectiveness. If water drafting were to occur with eggs present in adjacent redds, it is possible that deposition of suspended sediment could fill interstices of stream bottom substrate, depriving incubating eggs of dissolved oxygen and resulting in their mortality.

While screening intakes can reduce effects to fingerlings and fry, minimization of impingement requires the use of specific mesh sizes, pumping rates, and sufficiently large screen areas, as outlined in the *NOAA Fisheries Water Drafting Specifications* (NOAA 2001). NOAA drafting specifications will be implemented during water drafting at all sites within Coho salmon CH. There is a very low probability of impingement given that fish have been routinely observed to temporarily move away from a drafting pump site when a truck or hose is detected. An important minimization measure is Watershed PDF-5, which requires that decisions regarding which drafting sites to use in a given area be coordinated with KNF fisheries biologists. Based on observations, it is anticipated that fish temporarily avoiding water drafting activities are not likely to experience reduced feeding success, nor be exposed to a significantly higher probability of exposure to prey.

Proximity. Numerous water drafting sites are within anadromous salmonid habitat (CH). Numerous drafting sites have been identified for use to provide greater flexibility in choosing the best source during Project implementation, and to minimize exposure of fish and particularly SONCC Coho salmon to water drafting. Not all sites mapped for potential use during the Project will be used. The timing of water drafting limits the potential for direct impacts to Coho salmo;: adults or eggs are not typically present, but juveniles may be present. Chinook and Coho egg incubation period is generally October through March, during the winter period. Therefore likelihood of water drafting having any effect on the reproduction of Chinook or Coho salmon is low. However, the potential for effects to rearing juvenile Coho salmon ranges from low to high, dependent upon the drafting site location and other localized conditions such as drought and/or other nearby water withdrawals related to wildfire suppression or private land activities.

Probability. Rearing juvenile Coho salmon would be expected to move away from drafting sites when a truck approaches or a hose is dropped. If an individual fish did not flee, there is a probability of impacts. Therefore the magnitude of potential effects is discussed below. Project design feature Watershed-5 further reduces the probability that Coho salmon would be present or affected by project water drafting, by requiring that KNF fisheries biologists help determine where drafting will occur. Sites that are not likely to have rearing Coho salmon present will be prioritized for use, such as mainstem sites on the Klamath, Scott, and Salmon rivers. Priority will also be given to sites that involve drafting relatively warmer waters in mainstem rivers; drafting from tributaries and colder water sources, especially in their lower reaches, will be avoided particularly during late summer and early fall (when fish survival is dependent upon thermal refugia). Water storage facilities such as foldable tanks are encouraged and will be assessed for sites with moderate flows that simultaneously support rearing SONCC coho salmon, and may be subject to high drafting use (e. g., Walker Creek). Project-related water drafting will be monitored, and shifted away from streams if their baseflows will no longer sustain drafting-related water withdrawal consistent with PDFs. The following creeks will be avoided, due to their small size, small summer base flows, and consistent presence of rearing SONCC Coho salmon - Tom Martin Cr, O'Neil Cr, Little Horse Cr, and China Cr.

PDFs eliminate any drafting site alterations within CH, such as deepening pools or removing , vegetation. Due to implementation of Forest Service BMPs and PDFs specific to water drafting, effects on anadromous salmonid habitat will be insignificant.

Magnitude. While screening intakes can reduce effects to fingerlings and fry, minimization of impingement requires the use of specific mesh sizes, pumping rates, and screen areas, as outlined in the *NOAA Fisheries Water Drafting Specifications* (NOAA 2001). NOAA drafting specifications will be implemented during project water drafting within Coho salmon CH (see maps in Appendix A for locations). Forest Service BMPs which require screening for aquatic species present, will be implemented at water drafting sites outside of CH. As described above, there is a very low probability of impacts, especially impingement on screens, given that fish routinely move away when a truck or hose is detected. It is anticipated that fish temporarily fleeing or avoiding water drafting activities are not likely to experience measurable reductions in feeding success, nor result in a high probability of exposure to prey, due to the limited extent of drafting

sites relative to other available and suitable habitat located adjacent to where drafting will occur.

The frequency of effects from water drafting is limited to dry months, during operations, and when those operations overlap with juvenile rearing (summer months). Drafting will be done in accordance to the NOAA *Fisheries Water Drafting Specifications* (NOAA 2001) and appropriate Project PDFs (Appendix E) and BMPs. By following these specifications and considering the mobility and likely behavioral response of Coho salmon to move out of the area when a truck approaches or hose is dropped, the effects of water drafting will have minor and insignificant direct effects on Coho salmon.

The direct effects of water drafting will be limited to periods of project implementation (short-term) and are likely to result in only minor effects on Coho salmon, and insignificant effects to anadromous salmonid habitat (including CH/EFH). Direct effects will be neutral in the long-term.

Stream Crossings. Installation of temporary stream crossings on proposed temporary roads will mostly occur in dry intermittent and ephemeral stream channels. Proposed temporary road actions that include stream crossings are: 46N41YA in Lower Grider Creek drainage, 46N78 in China Creek drainage, and 46N77 in Cliff Valley Creek drainage. None of the stream crossings are within fish-bearing habitat and stream crossings will not directly affect anadromous salmonids. Indirect effects are discussed below. Methods and minimization measures for stream crossings, including for culvert installation and dewatering/rewatering, were analyzed in the Facilities Maintenance and Watershed Restoration BA (USFS 2004) and these methods and measures will be implemented as part of this project to minimize direct and indirect effects. Due to the location of temporary stream crossing work upslope and at least 0.5 mile away from SONCC Coho salmon CH, and the localized nature of impacts from project stream crossing work, direct effects on Coho salmon are expected to be discountable, while effects on anadromous salmonid habitat at least 0.5 mile downstream are expected to be insignificantly small.

Legacy sediment site repair will include work at stream crossings to address sediment sources or to provide improved passage for aquatic species (see Appendix A for map of legacy sediment site repair in Elk Creek watershed). The proposed legacy sites are in the Elk Creek watershed (and one site in Lower Grider Cr drainage, if 46N41YA is used in the Project) but are not within anadromous salmonid habitat. PDFs and BMPs will be implemented to minimize short term effects. Because legacy sites are not within accessible habitat (at least 300 feet upstream), direct effects from legacy site repairs to Coho salmon are expected to be discountable, and effects to anadromous salmonid habitat will be insignificant. Indirect effects are discussed below.

Proximity. None of the legacy sediment site treatments or temporary stream crossing work will occur in habitat accessible to Coho salmon or other anadromous salmonids. None of the three temporary road actions that involve stream crossings are within CH. Proximity of these crossings to CH are as follows: 46N41YA, face drainage just over ½ mile upstream of CH in Grider Cr; 46N77 Cliff Valley Cr about 3 miles upstream of CH in Grider Cr; 46N78 South Fork Three Biscuit Cr about 2.5 miles upstream of CH in China Cr.

Six of the proposed culvert upgrade sites in Elk Creek Watershed are approximately 300 feet upstream of CH. Stream crossing work will occur in a dry channel wherever possible; and BMPs and PDFs will be implemented to minimize effects to aquatic species and habitat present. Because work will occur on existing roads and at existing crossings that have been previously disturbed, direct effects to anadromous salmonid habitat downstream (CH) are expected to be insignificant.

In summary, Project water drafting which would occur during 2015 and 2016, have the potential to affect Coho salmon juveniles from the 2014 and 2015 brood years that are rearing in the Project Action Area. Along with legacy sediment site restoration treatments on roads and crossings, which may occur over serveral years, these activites are: located outside of SONCC coho salmon CH; or, in the case of water drafting, will occur in a manner that complies with NOAA's Water Drafting Specifications, and will result in only localized, low impact, short-duration, and insignificant effects to salmonids, including SONCC Coho salmon. Other PEs will not result in direct impacts to Coho salmon as work will not occur within CH or within active stream channels.

Indirect Effects

Sediment

The following discussion is organized by PE, and includes an analysis of effects to the Sediment habitat Indicator group listed below, based on the potential for indirect effects associated with each PE:

- **Suspended sediment-intergravel DO/turbidity**: the risk of increased soil disturbance then sediment supply and delivery associated with all of the PEs.
- **Physical barriers**: the risk of increased soil disturbance then sediment supply and delivery associated with all of the PEs.
- **Substrate character and embeddedness**: the risk of increased soil disturbance then sediment supply and delivery associated with all of the PEs
- **Pools - frequency and quality, large pools, average wetted width/maximum depth ratio in scour pools in a reach**: the risk of increased soil disturbance then sediment supply and delivery associated with all of the PEs.
- **Off-channel habitat**: the risk of disturbance and increased peak flows and resulting channel changes associated with all of the PEs.
- **Change in peak flows**: the risk of disturbance and then increased peak flows associated with all PEs.
- **Increase in drainage network –roads**: increased disturbance and changes to the road drainage network associated with temporary roads and landings.

The Sediment habitat Indicator group is discussed collectively below under PE headings, including at the site- and watershed scale. The watershed scale effects analysis relies on the WSFR Hydrology Report (Mondry 2015) analysis and the interpretation of CWE modeling and results that compare pre-fire disturbance with post-fire and post-Project disturbance, at both the 5th-field and 7th field watershed scales. The mass-wasting (GEO) model was used to assess potential risk of channel changes from landslides and debris flows, which have a high likelihood of causing: channel morphological changes including channel bed aggradation (affecting fish passage, especially at lower flows within response reaches); reduced pool frequency and quality; and changes to channel

width/depth ratios. The ERA model was used to assess the potential for increased peak flows, including for temporary roads and landings.

The assessment of potential effects to the Sediment habitat Indicator group at the site-scale relies on field review of the proposed treatment units/areas, predictions of action effects based on past projects, literature reviews, and discussions with relevant interdisciplinary team members (geologist, hydrologist, silviculturist, wildlife biologist, and fire behavior specialist). The potential for Project-related sediment mobilization to affect aquatic resources downstream is based on site conditions (including unit-specific slope stability, soil types, disturbance potential, and effects minimization measures that are to be implemented).

1) Salvage Harvest and Reforestation

Salvage harvest will occur on about 7,829 acres. Areas proposed for treatment include 1) Areas of moderate to high severity vegetation mortality; 2) Areas determined to be feasible in terms of logging systems, accessibility, and economic viability; and 3) Areas with more than 10 contiguous acres of medium to high severity vegetation mortality. Only standing dead trees 14 inches in diameter at breast height or greater will be considered for commercial salvage harvest. Salvage logging will be accomplished by ground-based, skyline, and/or helicopter logging systems. All salvage units will be reforested with the need for site-preparation (site prep) evaluated prior to planting. Stream course Riparian Reserves, as well as inner gorges and active landslides, are excluded from salvage harvest units. Tractors and mechanical harvesters are excluded from all RRs associated with stream channels, active landslides, inner gorges, and toe zones of dormant landslide deposits (Watershed-4 PDF, Appendix E).

Figure 3 below displays an example of how these features overlap treatment units, and the first cut at what specific areas will be excluded from, salvage harvest units in the lower Grider Creek drainage. Precise lay out of RR and inner gorge features are determined in the field during unit layout when the site specific slopes and distances are determined. These features are identified on the ground using flagging and GPS points, and the excluded areas are identified on timber sale area maps. Proper implementation of these design features is critical to ensuring that the environmental effects forecast in Project documentation, including this BA, are representative of conditions on the ground. The Forest Service is responsible for laying out salvage units consistent with this Project description, as well as closely monitoring implementation throughout the Project.

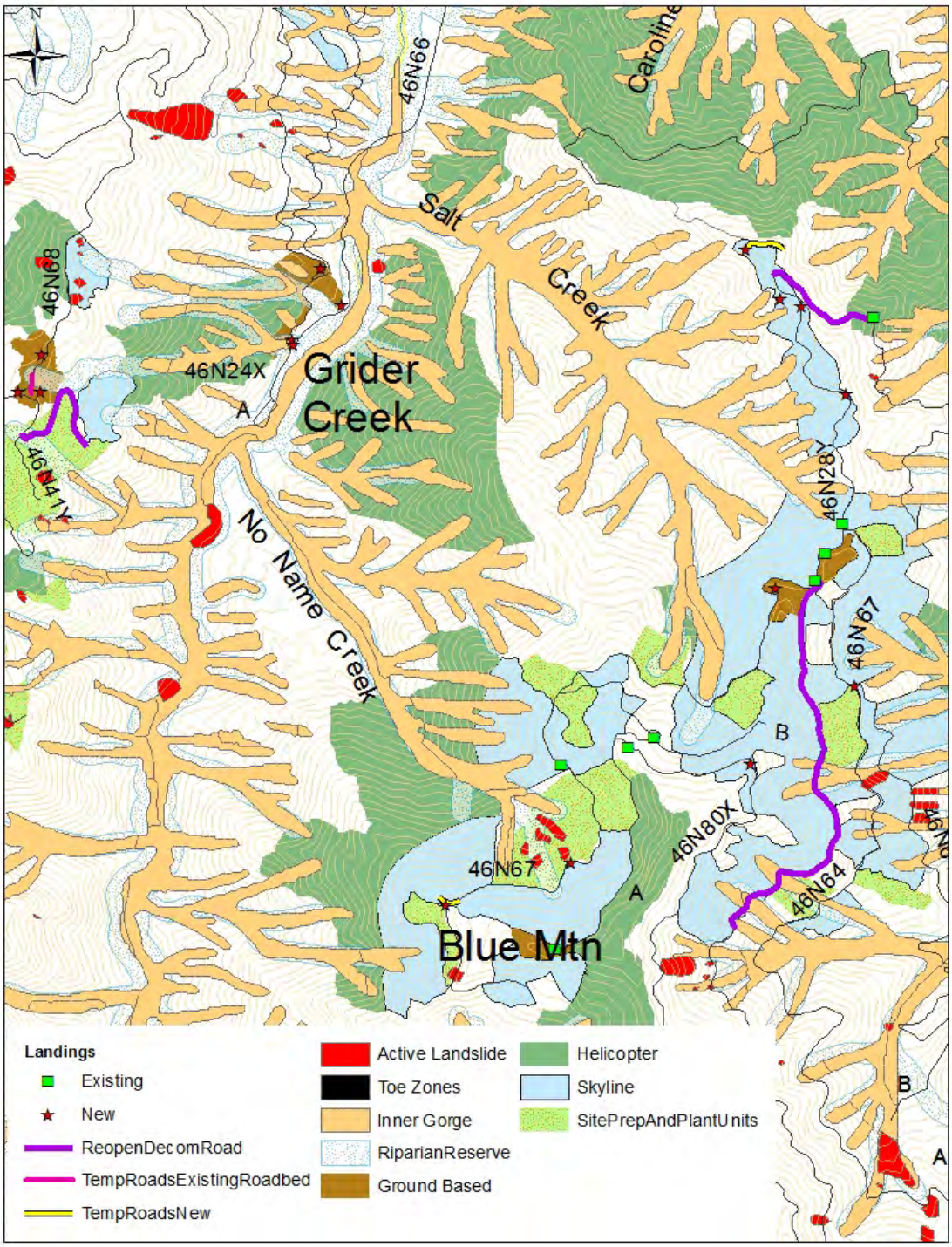

Figure 10. Proposed activities in lower Grider Creek displaying how RR, inner gorge, and active landslides will be excluded from units across the Action Area.

Reforestation includes site-preparation, planting, and release on approximately 7,873 acres, in addition to salvage harvest units, to increase the likelihood and speed at which burned areas are reforested. Like salvage harvest, all site prep and plant activities were planned to exclude Riparian Reserves. Methods for treatment may include: manual site

preparation, skyline yarding, mastication, mechanical yarding, and slash piling of dead trees.

Due to concerns from watershed specialists about the currently impaired function of heavily burned RRs, lop and scatter treatments, done by hand, are proposed within RRs where they overlap site prep and plant units. These activities would occur where safety of forest workers can be ensured. This treatment is proposed for RRs within plantations within the Happy Camp Complex and Whites Fire that burned with moderate to high severity: approximately 1,100 acres in the Happy Camp Complex and 127 acres in Whites Fire may be treated. These RRs hand treatment areas are scattered across the landscape and will be costly to implement. For those reasons, it is not clear at this time where these treatments will actually occur on the ground. Where they occur, these RRs hand treatments will increase near term soil cover and sediment filtering capacity in burned RRs. They are designed to reduce erosion and sedimentation at the site, and to encourage natural recovery of soils and vegetation. Detailed tables showing acres of RRs hand treatment proposed by 7th field watershed are in Appendix B.

Timber harvesting, including skid trails, landing and road construction, can increase soil disturbance, erosion, and sediment delivery to streams. Soil disturbance and loss of cover exposes soil to raindrop impact and subsequent erosion. Eroded soil moves from hillslope to stream channel via surface runoff, and occasionally via landslides. In sufficient quantities, fine sediment can reduce the abundance and quality of aquatic habitat. This is an indirect effect in that sediment movement is driven by winter storms or snowmelt events that occur following disturbance and effects can occur far downstream from sites of disturbance.

Altered sediment supply poses a stress to salmonids and other aquatic species. The AP Sediment habitat Indicator group includes key elements of anadromous salmonid habitat that can be adversely affected by an increase in sediment supply and delivery to streams, as well as mechanisms that can increase sedimentation including the following: suspended sediment/intergravel dissolved oxygen/turbidity, physical barriers, substrate character and embeddedness, pools frequency and quality, average wetted width/maximum depth ratio in scour pools in a reach, change in peak flows and increase in drainage network. Effects to sediment supply and delivery to streams are also analyzed at the site-scale and any aggregated effect is then inferred to affect the sediment-related indicators listed above.

Stream temperature (discussed below under the Water Quality Indicator) may also be indirectly affected through changes in sediment supply and delivery to streams via changes in channel morphology (pool depths or increases in width-to-depth ratio), which can facilitate heat exchange (Poole and Berman, 1999). In addition, fine sediment may block exchange between surface waters and intragravel flows, also contributing to warming. This discussion focuses on effects to sediment, and where those effects are determined to have a measurable or significant impact on temperature through the pathways described above.

Measurable changes in watershed sediment supply and delivery are particularly important relative to the Physical Barrier habitat Indicator because this may mediate access to tributary rearing habitat and refugia within Actions Area streams. Access to some

refugial areas from the mainstem Klamath River is currently blocked in some locations by alluvial barriers resulting from sediment loads flushing out of watersheds.

In addition, excessive fine sediment reduces habitat diversity, embeds spawning gravel, and reduces channel stability. Soils in the Action Area in some watersheds are highly erodible, and in combination with the steep terrain, recent fires, and a legacy of past timber harvest and road-building, fine sediment loading has contributed to impaired aquatic habitat conditions in some areas. This impairment is indicated by the pre- and post-fire CWE modeling data.. This discussion focuses on effects to sediment, and where those effects are determined to have a measurable or significant impact on barriers through the pathways described above.

The method of salvage harvest used affects the extent of watershed disturbance. Chase (2006) compared sediment production rates from sites burned at high severity and subjected to helicopter, cable or tractor logging and found that cable- and tractor-logged sites have significantly more ground disturbance than sites logged by helicopter (Chase 2006). The effect of different salvage logging methods on percent ground disturbance was studied by Klock (1975) who reported that the mean percent ground disturbance for tractor skidding over bare ground was 36%, 32% for cable logging without full suspension, 2.8% for cable logging with full suspension and less than 1% for helicopter. Chou et al. (1994a; 1994b) also measured disturbance after salvage logging on the 1987 Stanislaus National Forest fire and reported the mean ground disturbance for tractor logging was 35% versus 18% for cable-logged sites. Some studies have argued that salvage logging may reduce post-fire sediment production by breaking up soil water repellency and increasing infiltration rates by disturbing sealed soil surfaces (Bautista et al. 1996). Slash from salvage logging can increase percent cover and surface roughness, thereby reducing overland flow velocities and surface erosion (Shakesby et al. 1996; Poff 2002).

Wagenbrenner et al. (2014) found that skidder and feller-buncher plots generally had greater compaction, less soil water repellency, and slower vegetation regrowth than untreated control plots. Adding slash to skid trails increased total ground cover and reduced sediment yields by 5-50 times compared to untreated plots. Vegetative regrowth and sediment production varied widely among the study areas due to differences in rainfall and soil properties, however, susceptibility to surface runoff and erosion after high severity fire suggests that areas disturbed by ground-based salvage logging need additional mitigation.

Table 31 shows modeled CWE results pre-fire, post-fire and post-Project. Disturbance from the 2014 fires was high in some watersheds, increasing risk ratios in Beaver Creek, Lower Scott River, Thompson Creek and North Fork Salmon. Disturbance associated with implementation of salvage harvest and all associated actions was modeled against the post-fire baseline. At the 5th-field watershed scale, the proposed action including salvage harvest and reforestation does not add any incremental increase in disturbance beyond the 2014 fires to runoff (ERA), mass wasting (GEO) or sedimentation (USLE). Similarly, the project will have insignificant effects to sediment and anadromous salmonid habitat, and by extension, insignificantly small effects to SONCC Coho salmon at the 5th field watershed scale.

Table H-31. CWE model results at 5th field watershed scale comparing pre-fire conditions, no action, and effects of Consultation Action.

5th-field Watershed Name	Area (Acres)	Pre-Fire (2012)	Post-Fire, No Action	Consultation Action	2014 Fire Area
Beaver Creek	69,610	0.7	1.0	1.0	Beaver Fire
ERA		1.1	1.2	1.1	
USLE		0.8	1.1	1.0	
GEO					
Horse Creek-Klamath River	98,625	0.7	0.7	0.7	
ERA		0.7	0.8	0.8	
USLE		0.7	0.9	0.9	
GEO					
Humbug Creek-Klamath River	68,023	0.6	0.3	0.3	
ERA		0.6	0.5	0.6	
USLE		0.8	0.8	0.9	
GEO					
Elk Creek	60,829	0.5	0.5	0.5	Happy Camp Complex
ERA		0.1	0.3	0.5	
USLE		1.0	1.0	0.5	
GEO					
Lower Scott River	98,016	0.1	0.5	0.6	
ERA		0.1	0.5	0.4	
USLE		0.3	0.6	0.6	
GEO					
Seiad Creek-Klamath River	81,706	0.6	0.6	0.6	
ERA		0.3	0.7	0.3	
USLE		0.5	0.8	0.7	
GEO					
Thompson Creek-Klamath River	67,301	0.1	0.4	0.4	
		0.4	0.3	0.2	
ERA		0.4	0.5	0.6	
USLE					
GEO					
North Fork Salmon River	130,545	0.2	0.3	0.3	Whites Fire
ERA		0.1	0.3	0.3	
USLE		0.5	0.7	0.7	
GEO					

In addition to the assessment of watershed-scale effects to sediment at the 5th-field watershed scale, the hydrology assessment modelled and interpreted past and predicted disturbance at the 7th field watershed scale. The WSFR Hydrology Report (Mondry 2015) and Appendix B to this BA include more detailed CWE modelling results, summarized here.

For the ERA model, which is used to assess relative effects to watershed sediment regimes and peak flows, the following 7th field watersheds are at or above the 1.0 risk ratio threshold of concern pre- and post-Project: Buckhorn Gul-Beaver Creek, Doggett Creek, Dutch Creek, Jaynes Canyon, Kohl Creek, Lower West Fork Beaver Creek, Soda Creek-Beaver Creek, Big Ferry-Swanson, Middle Elk Creek, Walker Creek, and Music Creek. The incremental increase to ERA risk ratio added by this Project is small, with a maximum increase of 0.3. The 7th field watershed with the lowest overall impact of the Project, as reflected by ERA risk ratio, is Lower East Fork Elk Creek and Cougar Creek-Elk Creek drainages which both have zero change due to the Project. The lack of increase

in post-Project ERA risk ratio is because the Project includes substantial legacy sediment site treatments (which are assigned negative ERA values), and a relatively small amount of ground disturbing and road-related actions in these drainages (see Appendix B tables for ERA accounting by 7th field watershed). The 7th field watersheds with the highest overall impact of the Project, as reflected by ERA risk ratio, are Whites Gulch and Upper North Russian Creek at 0.3 increase. This increase is expected to have only insignificant effects on sediment production and anadromous salmonid habitat, including SONCC Coho salmon CH, in the Salmon River Watershed. The Beaver Fire area drainages were the most disturbed pre-Project as reflected by CWE values. Project activities in the Beaver Fire area are limited to 350 acres of salvage, scattered in several units across Kohl, Doggett and Beaver Creek drainages, and 0.8 miles of temporary road on existing road bed. Approximately 1,700 acres may receive site prep and plant treatments, dependent on funding availability. These activities constitute a minor level of ground disturbance scattered across drainages and Project actions will help recover late seral forests more quickly in treated areas.

For the GEO model, which is used to assess landslide risk and potential resulting channel changes, the following 7th field watersheds are at or above the 1.0 risk ratio threshold of concern pre- and post-Project (driven largely by 2014 fire effects): Bishop Cr-Elk Cr, Lower West Fork Beaver Cr, Lumgrey Cr, McKinney Cr, Soda Cr-Beaver Cr, Bear Cr, Granite Cr, Middle Elk Cr, Schutts Gulch-Klamath River, Deep Cr-Scott River, Music Cr, O'Neil Cr, Doggett Cr, Caroline Cr-Klamath River, Dona Cr-Klamath River, Buckhorn Gul-Beaver Cr, Walker Cr, Lower Grider Cr, Kohl Cr, and Middle Cr. The incremental increase to GEO model risk ratio added by this Project is small, only up to 0.1. GEO model risk ratios are reduced post-Project in Elk Creek drainages due to proposed legacy sediment site fixes.

As described in the Project Geology Report, the proposed action would reduce the duration of elevated landslide risk for nine 7th field watersheds as compared to no action. The 7th field watersheds with a high landslide risk that will have a reduced duration of elevated risk are Upper Grider Creek, Cliff Valley, Lower Grider Creek, O'Neil Creek, Walker Creek, and Caroline Creek. These watersheds have a high percentage of steep, weathered granitic lands so the project will benefit this Riparian Reserve landform in the long-term by decreasing the duration of elevated risk of landslide events. The reduction in duration of elevated risk will benefit natural resources and infrastruction in the long-term. Middle Creek, Horse Creek, and Upper Elk Creek have a moderate landslide risk and will have a duration of elevated risk of 30 years with the proposed action. Lower Grider and Walker Creek have very high landslide risk due to the potential to impact private land – so the reduction of elevated risk from more than 80 years to 30 years is of great benefit for protecting human safety and private property as well as fish habitat in these drainages. Rancheria Creek drainage, which also has a very high landslide risk, will continue to have a greater than 80 year duration of elevated risk because there is less than 25% of the high and moderate vegetation burn severity areas being planted. See the Project Geology Report for detailed analysis of landslide risk and the project's expected influence on it.

CWE modelling estimates of watershed disturbance caused by the Project are relatively small when compared to projects that harvest live trees over the same acreage; the reason for this is that dead/dying trees do not provide the same essential functions on the

landscape as live forests. As described in detail in the Project Geology Report (Bell 2015), after trees die, root support begins to decline immediately and provides almost no support/soil stability after about a decade. In addition, mature conifers affect site hydrology and soil moisture through interception and transpiration, and these functions are lost after trees die. As reflected in the CWE model coefficients and outputs, the disturbance related to salvage harvest that drives potential impacts to mass wasting and hillslope processes is ground based harvest and infrastructure development such as roads and landings. The Project is comprised largely of skyline and helicopter logging systems, and is designed to avoid unstable features such as active landslides, inner gorges, and stream course RRs (as depicted in Figure 3). Therefore, the project involves a relatively low level of watershed-scale disturbance in the context of existing conditions; however there remains potential for site level impacts, especially where infrastructure would be constructed or developed.

In addition to a review of the CWE modelling results at the 5th- and 7th field watershed scale, potential impacts to sediment at the site scale were assessed, to identify appropriate impact avoidance and minimization measures. At the site-scale, salvage harvest and reforestation effects will be minimized through project design (excluding RR, inner gorges and active geologic features) and implementation of Watershed PDFs and BMPs (listed in Appendix E and Project FEIS).

RRs have been established along all streams to protect riparian function (see PDF Watershed-3) including sediment retention capacity. Trees will not be cut or removed from RRs as part of salvage harvest under all methods of removal/harvest (tractor, skyline and helicopter). The sediment retention function of RRs will not be impacted by salvage harvest. There would be benefits to sediment retention function in RRs that receive lop and scatter hand treatments to achieve near term ground cover; approximately 1227 acres within site prep and plant units scattered across the Happy Camp Complex and Whites fire areas may receive this treatment. At the site level, this treatment would reduce sediment inputs to streams and speed the recovery of soils and vegetation within RR. Upper reaches of East Fork Elk, Middle, and Tompkins are the creeks that stand to benefit the most from hand lop and scatter treatment in RR.

Salvage harvest will remove dead trees and contribute to a timely restoration of burned stands. Without capturing the value of dead trees via timber salvage, site restoration would likely be unsafe and/or cost prohibitive. Planting without site preparation would likely result in the loss of conifer plantations to fire before they mature, given the median 5-25 year fire return interval predicted within the Analysis Area.

Summary of Indirect Effects. At the watershed scale (5th- and 7th field watersheds), the 2014 fires resulted in measurable impacts to sediment supply and delivery in some watersheds as described above, and observed during 2014-2015 fall/winter storm events. However, the proposed action does not add any increase to modelled disturbance at the 5th-field watershed scale, and only a slight incremental increase to post-fire disturbance at the 7th field scale in some watersheds, as described above and displayed in Appendix B tables. The proposed action will remove burned trees and conduct reforestation which are likely to restore forested areas quicker than if no action were taken. Project designs, Watershed PDFs, and BMPs minimize effects through avoiding unstable areas,

minimizing ground disturbance and requiring erosion control. Based on these factors, salvage harvest and site preparation will have insignificant effects on the Sediment habitat Indicator group and anadromous salmonid habitat, and minor effects on SONCC Coho salmon. Activities proposed within RR of site prep and plant units (lop and scatter hand treatments) may have insignificant beneficial effects on the Sediment habitat Indicator group at the site, with insignificant or neutral effects to Coho salmon and CH.

Proximity and Probability. Maps in Appendix A show that units are within proximity to anadromous salmonid habitat. Because salvage harvest will not occur within stream course RR, it will occur greater than 300 feet from any stream with SONCC Coho salmon CH. The probability of effects to the Sediment habitat Indicator group and Coho salmon is insignificant, as described above.

2. Fuels Reduction Treatments

The proposed action includes treatment of hazardous fuels on about 22,307 acres and will include the following: hand work, mechanical thinning, mastication, lop and scattering, chipping, broadcast burning (including use of helicopters for ignition), jackpot burning, and pile burning. Fuels reduction activities near streams can increase the potential for sediment-related impacts to aquatic habitat. The proposed action includes fuels reduction within RRs within fuels management zones, roadside hazard reduction units, WUI's and underburn units (locations are shown on maps in Appendix A). Small diameter trees would be removed using a masticator and hand work, and fuels would be piled and burned.

Mastication using low ground pressure tracked or wheeled machines with a masticator head would be used to grind slash produced from mechanical thinning and existing ground fuels where feasible. Masticated material would be left scattered in treatment areas. Secondary treatment is required to dispose of activity-generated ground fuels and existing ground fuels to significantly decrease the potential for future stand-replacing fire effects. Secondary treatments would include mastication and prescribed burning, which includes burning piles of slash and underburning. The track-mounted excavator with masticator arm is restricted to slopes of 45% or less and when soil moistures are less than 18%. Masticators will cover their tracks/traces with masticated slash upon exiting fuels treatment units/areas, thereby reducing the potential of surface erosion from masticator-treated units (Blessing 2015). Therefore, insignificant amounts of rutting will occur when using this machine. In addition, the 30" track produces ground pressures of up to six psi, therefore chances of any soil compaction occurring is also insignificant. RRs in treatment areas could be treated with a masticator where feasible. The 50-foot treatment buffer on small perennial and intermittent streams and 100 foot buffer on larger perennials (> 1' wetted width) reduces the possibility of sediment reaching these streams to an insignificant risk. Indirect effects to sediment and anadromous salmonid habitat from mechanical and hand fuels treatments will be insignificant, while they will have minor effects on SONCC Coho salmon.

Burning under prescription can result in localized loss of protective soil cover. This effect would occur as a result of unforeseen prescribed burn flare-ups in fuel accumulations. Indirect effects involve the movement of sediment from areas with significantly reduced soil cover to stream channels and then downstream, to be deposited in pools and riffles. Such events are expected to be few in number and limited in size by the fact that burn

plans will be designed for retention of cover in burn areas in conformance with LRMP guidance, project-specific effects minimization measures (PDFs, RR Standards and Guidelines, Best Management Practices), and experience from decades of KNF prescribed burning. Should flare-ups occur, loss of soil cover would be localized and short-term as regrowth and adjacent unburned stands contribute to the rapid re-establishment of soil cover. Indirect effects from burning under prescription to sediment and anadromous habitat will be insignificant, while they will have minor effects on SONCC Coho salmon. Beneficial effects are expected in terms of less severe future fire effects, particularly when/if fire occurs in this area greater than 5 years in the future.

Project design standards, BMPs and PDFs will be implemented to minimize potential effects at the site-scale including the following (PDFs 33, 34, 35, and 36): prescribed fire effects will mimic a low intensity backing fire, except for handpiles/windrows where localized higher intensity may occur in consuming pile material; ignition of underburns will generally not occur in RRs; handpile and windrows in RRs will be placed in a checkerboard pattern whenever possible (not piled directly above one another); handpiles will be less than 6 feet in diameter and will be more than 15 feet away from intermittent streams and 30 feet away from perennial streams; for underburning, handline construction in riparian vegetation shall be avoided where practical but will be farther than 25 feet from any channel, if necessary; handlines will be mitigated (waterbarred and covered with organic material) immediately following prescribed burning, when safe to do so; When underburning in RRs, at least 90% of the large woody debris will not be consumed, both standing and on the ground; tractors and mechanical harvesters will be excluded from all RRs associated with stream channels, active landslides, inner gorges, and toe zones of dormant landslide deposits; and refueling will not take place within any RR. A spill containment kit will be in place where refueling and servicing take place. Indirect effects from prescribed fire/burning treatments, including within RRs, to sediment will be insignificant, while they will have minor effects on SONCC Coho salmon.

The risk of impacts to the Sediment habitat Indicator group at the site-scale is associated with soil disturbance within RRs. Watershed PDFs (as listed above) will be implemented to minimize effects of all project fuels reduction work.

At the 5th-field watershed scale, the proposed action including fuels reduction does not add any incremental increase in disturbance beyond the 2014 fires [to runoff (ERA), mass wasting (GEO) or sedimentation (USLE)]. At the 7th field watershed scale, the proposed action including fuels reduction is expected to add only an insignificant increment to disturbance beyond the 2014 fires: an amount that is predicted to have insignificantly small effects on sediment and anadromous salmonid habitat, while they will have minor effects on SONCC Coho salmon.

Summary of Indirect Effects. Handpiling and pile burning, heli-torch burning and underburning, may occur in RRs, comprising approximately 8,000 acres across the project area. These activities will remove soil cover in some areas and therefore has the potential to increase sedimentation. Project design, Watershed PDFs and BMPs will be implemented to minimize and mitigate effects including PDF 34, 35, 36 and 37, which require that piles not be stacked near each other, and that piles be small (<6 ft.). These

measures will limit disturbance and result in a low potential for erosion and sedimentation, and piles will be interspersed with undisturbed areas that will retain and.or intercept sediment. Treating hazardous fuels in RRs will mimic the effects of a low intensity fire and will likely reduce the effects of a future wildfire by reducing fuels, particularly when fire occurs greater than 5 years in the future. Given the minimization measures that will be implemented, indirect effects from handpiling and burning to Sediment and anadromous salmonid habitat will be insignificant, while they will have minor effects on SONCC Coho salmon, as defined on page 16 above.

Proximity and Probability. Maps in Appendix A show that treatment units are within proximity to anadromous salmonid habitat. However, the probability of effects to the Sediment habitat Indicator group and, by extenstion, to SONCC Coho salmon and their CH is insignificant, as described above.

3. Hazard Tree Abatement

The proposed action includes hazard tree removal along most Forest Service system roads, County Roads, and State Highways within the project boundary, and is estimated at 678 miles of roads (over a maximum of 20,499 acres). This is to be done to provide for public and Forest worker safety and future fire suppression efforts. Both the mileage and acres of treatment proposed are a maximum; the numbers are representative of the entire length and area being evaluated for hazard tree identification and removal. Trees determined to be a hazard to the roadway will be felled, this includes within RRs where roads intersect and/or parallel stream channels. Project design features require retaining hazard trees greater than 26 inches DBH on site when they are within one site tree height distance from fish-bearing stream, unless they continue to pose a hazard to safety or accessibility.

At the 5th-field watershed scale, the proposed action including hazard tree removal does not add any incremental increase in disturbance beyond the 2014 fires [to runoff (ERA), mass wasting (GEO) or sedimentation (USLE)]. At the 7th field watershed scale, the proposed action including hazard tree felling/removal only adds a slight incremental increase to disturbance beyond the 2014 fires, a level that is predicted to have insignificant effects on sediment and anadromous salmonid habitat, while they will have minor effects on SONCC Coho salmon.

The risk of impacts to the Sediment habitat Indicator group at the site-scale is associated with soil disturbance within RRs. Watershed PDFs (Watershed 4 and 13) will be implemented to minimize the effects of soil disturbance associated with hazard tree felling/removal, including the following: equipment will be excluded from the inner 50 feet of the non-fish bearing RR and one site tree height/distance for fish bearing streams; all hazard trees cut within 25 feet of a stream channel will be left on site; in fish-bearing stream reaches, all hazard trees greater than 26 inches in diameter at breast height within the first site tree (150-170 feet) will be left on site unless they continue to pose a hazard to safety or accessibility; live trees directly rooted into the banks or otherwise integral to the stability of the channel bank will not be felled unless they pose an overhead hazard and, if felled, will be left on site unless this poses a hazard on the ground per OSHA requirements; directional felling will be used to protect streambanks where hazard trees need to be felled/removed for public or employee safety; refueling will not take place

within RRs and a spill containment kit will be in place where refueling and servicing take place.

Summary of Indirect Effects. Based on implementation of the Watershed PDFs for hazard tree removal that require trees to be felled and left on site in near-stream zones, and field review of hazard tree removal areas, hazard tree removal along roadsides will have insignificant effects to the Sediment habitat Indicator group and anadromous salmonid habitat, and minor effects to SONCC Coho salmon.

Proximity and Probability. Maps in Appendix A and tables in Appendix C show that treatment units are within proximity to anadromous salmonid habitat. However, the probability of effects to the Sediment habitat Indicator group and Coho salmon is insignificant, as described above.

4. Temporary Roads, Landings and Water Drafting

The proposed action includes approximately 16.4 miles of temporary road segments to access harvest units: 1.2 miles in the Beaver Fire; 14.3 miles in the Happy Camp Complex; and 0.8 miles in the Whites Fire. New temporary roads are proposed on a total of 3.4 miles; 13 miles are proposed temporary roads on existing roadbeds, of which 5.6 miles are decommissioned road beds proposed for opening/use/re-decommissiong. The total road mileage is divided among several short segments designed for temporary use, and dispersed among numerous 7th field subwatersdeds (Appendix B, Table 1). After use, all project temporary roads will be hydrologically stabilized, which includes constructing waterbars, outsloping road prisms if appropriate, removing crossings and obliterating access to the road.

Roads can have a major impact on sediment and the drainage network. Disturbance associated with temporary roads and crossings were modelled in the CWE analysis. At the 5th-field watershed scale, the proposed action including these PEs, does not add any incremental increase in disturbance risk. At the 7th field watershed scale, the proposed action including these PEs adds only a slight increase in risk beyond the baseline, and only in some watersheds. Effects to sediment at the watershed scale are expected to be insignificant and undetectable downstream.

Project design, Watershed PDFs and BMPs will be implemented to avoid unstable areas and to minimize potential adverse effects at the site-scale *during project implementation*, including the following: fill materials generated from road treatments will be reincorporated back into subgrade to the extent possible; all excess fill materials will be spoiled outside of RRs; all project-related temporary structures, materials and debris will be removed from riparian areas and stream channels prior to winter shutdown; activities which require culvert replacement or removal will occur during the least critical periods for water and aquatic resources: when streams are dry or during base flow conditions, and in compliance with spawning and breeding seasonal restrictions; upgrades or improvements to stream crossings will be built to Forest Plan standards; new temporary roads or landings will not be constructed in any RR associated with stream channels, on toe zones of landslides, active landslides or inner gorges.

Watershed PDFs and BMPs will be implemented post-project to minimize adverse effects at the site-scale *until vegetative recovery can occur*, including the following: following

harvest activities, maintain at least 50 percent slash on temporary roads and block them after the harvest season (prior to the first winter after use); temporary roads will be sub-soiled; all temporary roads will have their takeoffs from system roads obliterated or blocked to avoid unauthorized use; hydrologic stabilizations, which may include removal of culverts and fills at stream crossings, out-sloping of road surfaces and/or obliteration of temporary road segments; erosion and sedimentation control structures will be maintained and repaired per the guidance in the Forest Service Handbook 2409.15 R5 Supplement.

Figure 11. Stream crossing proposed for re-opening in Cliff Valley Creek.

Even with implementation of BMPs and PDFs, watershed specialists were concerned about temporary road construction exacerbating currently at risk watershed processes related sediment supply and delivery. Temporary roads, both re-opened and new, that are hydrologically linked via stream crossings were of greatest concern, as were log landings (re-opened and new) in RRs, and unstable areas crossed by roads. The proposed action includes nine temporary road stream crossings. These features were analyzed by watershed specialists on a site-specific basis using GIS data and field surveys. A total of 3.4 miles of new temporary roads are proposed, 3.3 miles in Happy Camp Complex and 0.1 miles in the Whites Fire. These new temporary roads consist of multiple short segments of road on ridgetops designed to facilitate skyline logging systems. They are all outside of RR and disconnected from the drainage network so there is not any meaningful risk of effects to downstream fish habitat as a result of these short ridge top new alignments.

Temporary road actions include nine stream crossings (2 perennial and 7 intermittent streams) that are above the range of fish (greater than ½ mile above CH) in Lower Grider Creek, Cliff Valley Creek, and China Creek. Temporary road actions proposed in Lower Grider, Kuntz and O'Neil creeks will require restoration actions to address existing erosion related concerns. Field surveys determined if reopened roads, crossings, and landing sites were actively eroding or at risk for erosion pre-project. If the project uses these roads that have existing erosion problems, they will have to be appropriately hydrolgically restored according to current standards which would yield post-project hydrologic benefits in these watersheds. For example, the temporary road proposed for use in lower O'Neil Creek is in the outer portion of O'Neil Creek RR but currently captures an intermittent stream channel along several stretches of the road. If the project

uses this road, the drainage features will be fixed so the road can be used and appropriately hydrologically stabilized post-project. In this case, project use of the road poses only a low short term risk to aquatic habitat and a long term benefit would be expected due to appropriate hydrologic stabilization of this existing road bed. The temporary road actions in lower Kuntz Creek involve a similar low short term risk of effects due to use of the road, and long term benefits from fixing existing erosion problems on the road.

Crossings on decommissioned roads in Cliff Valley and China creeks proposed for reopening have been, for the most part, appropriately hydrologically stabilized. Project use and re-closing of these roads and crossings involves a low to moderate short term risk to aquatic habitat and no long term benefit. Temporary stream (perennial and intermittent) crossings would likely have short duration effects to sediment production limited to the first winter after use. Due to implementation of effects minimization measures (BMPs and PDFs) effects are expected to be site-scale and limited to the immediate area downstream of work.

Watershed specialists identified all potential stream crossings on temporary roads and reviewed them in the field to determine what actions would be taken and what effects to downstream fish habitat may occur. Table 32 lists the sites that remain in the Consultation Action. There were several other potential crossing sites initially included in the proposed action and reviewed in the field. These sites are not listed in Table 32 as they were found to not have channel crossings or were dropped from the project (comprehensive list of crossings reviewed is available in project record).

Table H-32. Temporary roads/stream crossings.

Receiving Stream Name	Road Type	Confirmed Stream Type	Comments
Grider Creek	Decomm. Road 46N41YA	2 perennial	One crossing is legacy site; the Project will reduce sediment long term
Walker Creek	Decomm. Road 46N63	No crossing	No crossing features; old road bed cut in bedrock
Cliff Valley Creek	Decomm. Road 46N77	1 Intermittent	Stable, moderate risk
China Creek	Decomm. Road 46N78	5 Intermittent	Stable, low risk
Kuntz Creek	New Temporary Road	No crossing involved in road (except crossing of private diversion ditch)	Road has drainage problems; use of road is low risk; the Project will reduce sediment long term
O'Neil Creek	Existing Temporary Road #2 and #3	1 intermittent	Road has drainage problems; intermittent channel captured by road prism; use of road is low risk; the Project will reduce sediment long term

The effects on unstable lands related to re-opening temporary roads on existing roadbeds and decommissioned roads or building new temporary roads is incorporated into the project landslide risk assessment. The main effect on landslide risk from road crossings is

the increase in debris flow volume when and if the debris flow removes the crossing, incorporating crossing material into the debris flow. Debris flow volume is directly correlated with the probability of damage to structures, infrastructure (roads, power corridors, water lines, etc.) and natural resources. The more crossings in a watershed, the more likely that if a debris flow should occur the volume will be increased. Crossings built on new temporary roads or re-constructed on decommissioned or existing temporary roads will be removed before the rainy season (see Chapter 2 of DEIS). The excess material will be removed before debris flow events are likely, making the increase in risk small.

Based on site reviews and proper implementation of BMPS and PDFS, the intensity of effects would be low for individual crossings. Further, it was determined during site reviews that sediment sources on some of the roads would be remediated, resulting in a long-term reduction in sedimentation. Construction of new temporary roads outside of RRs and use of existing road alignments and temporary crossings will have insignificant effects to the Sediment habitat Indicator group and anadromous salmonid habitat, and minor effects to SONCC Coho salmon.

The proposed action includes use of existing landings where available, and construction of new landings. A maximum of 75 existing landings and 135 new landings are proposed for use. Proposed landing locations are on maps in Appendix A. A maximum number is proposed to allow flexibility for contractors during implementation of the Project, however, far fewer landings will actually be used. Landing size will be commensurate with operational safety. Helicopter landings will be up to two acres in size. Skyline landings will use roads where ever possible. New skyline landings off the road system and ground-based landings will average one acre in size, but will not be larger than 1.5 acres in size. Both new and existing landings will be hydrologically stabilized after use.

The project includes PDF Watershed-5 that restricts new landings in RR to only those that have been reviewed and approved for use by watershed specialists. Conditions that provided for field-surveyed log landings to be approved for use included: on stable landforms and slope positions; in the outer zone of the RR; or separated from perennial streams by existing, stable road segments. Landings were not approved for use if they required removal of mature vegetation or significant earthwork or fill manipulation.

Site-scale effects to sediment from log landings would depend on landing location, existing condition, and size/use. A new landing within a site-tree distance of Coho CH represents a high risk of affecting sediment in CH. These effects could be of moderate duration and low to moderate intensity, depending on the volume of potentially unstable material and occurrence of stochastic weather-related events. However, only a limited number of new landings in RRs were approved (landings #DZ03, DZ10, DZ23, L043, L044 and L090) and only if they were on stable/already compacted landforms and slope positions, were in the outer zone of the RR, or were separated from stream channels by existing, stable road segments. Landings were not approved for use if they would require removal of mature vegetation or significant earthwork or fill. Landing L072 was proposed in RR within Whites Gulch, but a new location has recently been identified that is outside of RR.

Table H-33. New landings in RR, approved for use.

7th field Watershed	Landing ID	Type	Comments

7th field Watershed	Landing ID	Type	Comments
Caroline Creek-Klamath River	DZ03	Heli	In outer site tree of RR associated with Klamath River (CH). Trees that provide shade to the Klamath River would not be removed and ground disturbance would occur in an area of mine tailings and already compacted ground.
Cliff Valley Creek	L090	Skyline	In RR associated with non fish bearing tributary, over 3 miles above CH. Old stable and outsloped road bed within heavily burned and steep intermittent drainage. Strict implementation of Watershed PDFs and BMPs are critical during use and hydrologic stabilization actions. Detectable impacts to downstream fish habitat are not likely.
Franklin Gulch-Scott River	DZ10	Heli	In RR associated with lower Scott River (CH). The area is a flat already-compacted terrace above the Scott River. Trees that provide shade to the river would not be removed. Earthwork to expand the area would not occur.
Lower Grider Creek	DZ23 L043 L044	Heli	In outer site tree of RR associated with Grider Creek (CH). These landings are proposed in a heavily burned area between high use roads (switchback near Grider Campground) and within gound based salvage units. There are several intermittent stream channels that drain through the area but landing locations are rocky and relatively flat. No trees that provide shade to Grider Creek would be removed and post project hydrologic stabilization treatments, potentially including planting, would help recover this area to a forested condition.

Watershed PDFs and BMPs will be implemented to minimize impacts to sediment from existing and new landings in RRs including the following: new landings will not be constructed in any RR associated with stream channels (exceptions to this project design feature are landings #DZ03, DZ10, DZ23, L043, L044, and L090), on toe zones of landslides, active landslides or inner gorges; existing landings will be used to the extent possible; existing landings in stream-course RRs will not be expanded towards stream channels, or on to active landslides, or where vegetation that provides shade to a stream would need to be cut; existing landings in RRs will be shaped and treated for erosion control at the end of each season of use, and hydrologically restored at project completion (including subsoiling and covering with slash/mulch as needed); reused landings in RRs will have site specific erosion control measures to reduce risk of sediment delivery into streams; refueling will not take place within the RR; a spill containment kit will be in place where refueling and servicing take place; at project conclusion, landings will be configured for long-term drainage and stability by reestablishing natural runoff patterns; all landings will be covered with at least 50 percent effective soil cover; use of certified weed free materials including straw, wood chips, or mulch may be used where on-site material is insufficient; identified (selected) landings will be subsoiled, then covered with at least 50 percent effective soil cover. Use of existing landings and construction and restoration of new landings will have insignificant effects to the Sediment habitat Indicator group and anadromous salmonid habitat, and minor effects to Coho salmon.

Water drafting (locations are shown on maps in Appendix A) can result in indirect effects through short term and localized increases in turbidity when substrates are disturbed as the water hose is set into and pulled from the water. Watershed PDFs (37 and 38) will be implemented to minimize effects of water drafting on sediment supply and delivery including the following: draft water only at designated water drafting sites;

when drafting from waters designated as Coho salmon CH, implement NOAA Fisheries Water Drafting Specifications (2001) and implement Forest Service Best Management Practices. Existing water drafting sites will be used to avoid new streamside disturbance associated with construction of drafting sites. Turbidity that may result during water hose sets and removals will be localized, limited to pre-designated sites (see Appendix A), and fish are expected to temporarily move away from these areas once they sense a water truck approaching. A measurable increase in turbidity is not expected beyond the immediate drafting area. This conclusion is based on field observations that indicate turbidity is diluted to background water clarity conditions within a few seconds of placement/removal of water drafting hardware. Thus, water drafting will result in insignificant effects to the Sediment habitat Indicator group and anadromous salmonid habitat, and minor effects to Coho salmon.

Summary of Indirect Effects. At the 5th-field watershed scale, the proposed action, including roads and stream crossings, does not add any incremental increase in disturbance. At the 7th field watershed scale, the proposed action including roads, landings, stream crossings and water drafting add only a slight increase to post-fire disturbance, in some watersheds. At the watershed scale, the proposed action will have insignificant effects to sediment and anadromous salmonid habitat, and minor effects to Coho salmon. At the site-scale, roads, stream crossings and landings in RRs represent a high risk for effects and were reviewed by watershed specialists in the field to determine if BMPs and PDFs would effectively minimize impacts. There is potential for site-scale impacts to sediment particularly at road stream crossings. In some areas determined to be legacy sediment sites, conditions will be improved by the project therefore site scale long term benefits are expected. None of the temporary road crossings are within anadromous salmonid habitat, they are all greater than ½ mile from SONCC Coho salmon CH. Temporary roads with stream crossings are expected to have site-scale, short-term adverse effects to sediment and minor effects to Coho salmon.

Proximity and Probability. Maps in Appendix A show that temporary roads and stream crossings are not within proximity to fish-bearing streams. Watershed specialists confirmed locations and conditions in the field at all proposed road/stream crossing sites. At the watershed-scale, roads and stream crossings have a low probability of effects on the Sediment Indicator group, anadromous salmonid habitat and Coho salmon. At the site scale, there may be short term negative effects to aquatic habitat due to temporary road crossing actions. Watershed specialists confirmed that a fewof the crossings were existing sediment legacy sites that are currently contributing sediment to drainages, and that the project will reduce sediment at these sites in the long term. At the site-scale, the probability of effects from landings in RRs is not insignificant (there is a risk of adverse effects). Thus, the magnitude of effects from landings in RRs will be discussed further below.

Magnitude: All proposed new landings in RRs were reviewed in the field. Watershed specialists determined that that soil disturbance would be minimized and that BMPs and Watershed PDFs will effectively minimize impacts. The magnitude of effects is limited in scope to landing #DZ03, DZ10, DZ23, L043, L044, and L090 and potential impacts will be minimized through implementation of BMPs and PDFs. The magnitude of effects to the Sediment habitat Indicator group is insignificant. New landings in RRs will have

insignificant effects on sediment and anadromous salmonid habitat, and minor effects on Coho salmon.

5. Legacy Sediment Site Treatments

Legacy sediment site treatments are proposed to reduce sediment supply and delivery through restoration of known sites in the Elk Creek watershed. These treatments will be scheduled for treatment in compliance with the Clean Water Act as a condition of the North Coast Regional Water Quality Control Board waiver of waste discharge requirements (Order No. R1-2010-0029). The portion of Elk Creek within the project area contains approximately 148 legacy sites. Most of the legacy sites are located on or adjacent to the Forest road transportation system. The other legacy sites are located on existing landings or roadbeds (historic roads, abandoned temporary roads, or decommissioned roads). Legacy site treatments will include the following:

- Culvert upgrades (about 45 sites) – replace culverts to accommodate the 100-year peak flow;
- Diversion prevention (about 51 sites, 17 include culvert upgrade) – construct armored rolling dips to prevent streams from diverting down roadways, should the culvert plug or fail;
- Aquatic organism passage (three sites)– replace existing stream crossing with bottomless arch culvert to improve or restore aquatic organism passage;
- Retaining wall (about 7 sites) – construct Hilfiker wall, rock buttress, reinforced embankment, or equivalent, where road prism has slumped or failed;
- Fill reduction (about 16 sites) – remove excess fill materials from the top of stream crossings to reduce the amount of fill available for discharge should the culvert plug or fail; add riprap to armor fill slopes;
- Fill removal (about 27 sites) - remove all fill materials from stream channels, swales, road shoulders and sliver fills; these treatments would occur on closed NFTS roads and existing roadbeds;
- Repair/maintain existing infrastructure (about 16 sites)– clean culvert inlets, ditches, etc., repair damaged culvert inlets, shorten “shotgun” culvert outlets, place riprap below culvert outlets to reduce hill slope erosion, remove cut slope slide materials,

In addition, road storm-proofing treatments between individual legacy sites will occur on about 33 miles of Forest system roads (15N02, 15N75, 16N05, 16N39 and 45N19). Treatments between legacy sites may include the following: where possible reconstruct road prism to an out sloped configuration, otherwise reduce inboard ditch length by adding additional relief culverts or dips; reduce road prism width; remove berms; place rip-rap below outlets of ditch relief culverts; recondition road subgrade and travel surface - apply crushed aggregate; add rolling dips where needed to control road surface runoff; stabilize road prism slumps with retaining walls or rock buttresses.

The potential for indirect effects to the Sediment indicators is highest for culvert upgrades or passage projects that are within active stream channels. The culvert projects will likely generate some short-term turbidity downstream. The proposed culvert upgrade actions in Elk Creek watershed were included in the programmatic BA Klamath National Forest Facility Maintenance and Watershed Restoration BA (USFS 2004), and thus

covered by the associated letter of concurrence (NMFS 2004). Turbidity from these types of projects was determined to have an insignificant, temporary impact where actions occurred less than 300 feet from areas occupied by fish; and where in-channel actions were greater than 300 feet from fish, no effect to fish was expected. In the long term, turbidity levels will return to pre-construction conditions as the site settles/stabilizes. Observation has confirmed that such settling/stabilization usually occurs after the first few precipitation events. None of these sites are within habitat accessible to anadromous salmonids. PDFs (Watershed-20 and 24) will be implemented for all projects to minimize impacts to sediment and aquatic habitat. All together, these legacy sediment site treatments will result in meaningful benefits to water quality and fish habitat in Elk Creek watershed, as well as improved passage for aquatic organisms and watershed products.

Summary of Indirect Effects. Legacy site repair will result in insignificant and short-term effects to the Sediment habitat Indicator group and anadromous salmonid habitat, minor effects to Coho salmon, and long-term beneficial effects to both sediment and Coho salmon through reducing sediment sources in the Elk Creek watershed.

Proximity and Probability. Maps in Appendix A indicate the proximity of legacy site repairs to CH. All project legacy sediment site crossing upgrade work will be outside of SONCC Coho salmon CH, and all but six sites are located at least 300 feet away from CH. The six sites that are relatively close to CH (300-400 feet upstream of CH) are culvert upgrades along side tributaries to Elk Creek, and East Fork Elk Creek. Implementation of these actions will adhere to all protection measures outlined in the Facilities Maintenance and Watershed Restoration Programmatic BA (2004), and Appendix E of this BA. Work will be scheduled to occur when channels at culvert upgrades are likely to be dry.

Two of the three aquatic organism passage improvement crossings (upgrading culverts to open bottom structures) are approximately 350 feet upstream of CH in Elk Creek in Twin and Malone Creeks. The third aquatic organism passage improvement crossing is approximately 2.5 miles above CH in upper East Fork Elk Creek.

The probability of negative effects to sediment is highest in the short term after implementation in sites that are close to CH (~300 feet away). However, the probability of effects to the Sediment habitat Indicator group and anadromous salmonid habitat is insignificant due to the requirement to work in a dry channel and adhere to all protection measures outlined in the Facilities Maintenance and Watershed Restoration Programmatic BA (2004) and associated Letter of Concurrence. Experience with similar projects supports that BMPs and Watershed PDFs as described in the programmatic BA (and Appendix E of this BA) will effectively minimize impacts related to sediment to insignificant levels. This work will result in long-term benefits to sediment and Coho salmon as sediment sources are reduced and passage of watershed products in Elk Creek Watershed is improved.

Water Quality

Effects on the Water Quality habitat Indicator group associated with changes to sediment supply and delivery are discussed above (e.g. turbidity) under the Sediment habitat Indicator group. The potential for changes to base flows are associated with water drafting, and are discussed above under direct effects. This discussion includes effects of

each PE on the following Water Quality habitat Indicator group based on the potential for indirect effects (see Analysis Methods section):

- Water Temperature: Potential effects are associated with alteration of stream shade along perennial streams associated with the following Project activities that will occur within RRs. reforestation/site preparation, hazard tree removal, fuels reduction, temporary road and landing construction and legacy site treatments.
- Chemical Contaminants/Nutrients: Potential effects are associated with use of mechanized equipment within RRs associated with the following activities: reforestation/site preparation, hazard tree removal, fuels reduction treatments, construction of temporary roads and stream crossings, landings and legacy site treatments.
- Refugia: Potential effects are associated with alteration of stream shade associated with the following activities that occur within RRs: reforestation/site preparation, hazard tree removal, fuels reduction, temporary road and landing construction and legacy site treatments. Channel aggradation associated with mass wasting and debris flows has the potential to affect channel morphology and affect fish passage to thermal refugia in tributaries. This potential effect is discussed above under the Sediment habitat Indicator group.

The WSFR Hydrology Report indicates that there are currently eight 7th field watersheds with high risk of temperature regime alteration: Buckhorn Gulch-Beaver Creek, Kohl Creek, Lower Grider Creek, O'Neil Creek, Walker Creek, Caroline Creek, Granite Creek and Middle Elk Creek. All of these watersheds have elevated risk due to the effects of the 2014 wildfires. There are twenty-one and forty-five watersheds with a moderate and low risk, respectively.

Maintaining or restoring stream shade as a way to control water temperature is important. Ambient air temperature over the stream drives maximum water temperature, along with other factors that influence humidity and other micro-climate conditions (Bartholow et al 1989, Essig 1999). The width of RRs, not just shade canopy is key to maintaining micro-climate conditions. FEMAT (1993) called for protection of two site potential tree heights or 300 feet, for all fish-bearing streams. Spence et al. (1996) note that the absolute minimum buffer width for maintaining cool air flow over the stream is one site potential tree height. The proposed action includes RR widths of two site potential tree height along fish-bearing streams and one site potential tree height along non-fish bearing streams. RRs are protected from salvage harvest, but some vegetation management will occur within RRs (fuels treatment, hazard tree removal, legacy site treatments). Watershed PDFs, as described below, will be implemented to maintain water quality, including existing stream shade.

Poole and Berman (1999) noted that large wood jams can contribute to stream cooling by forcing more stream flow into shallow ground water, which is called the hyporheic zone. The water drops slightly in temperature before emerging downstream. Temperature effects associated with large wood are discussed below under the Riparian Function habitat indicator group.

Activities within RRs have the highest risk of affecting the Water Quality habitat Indicator group. Table 34 summarizes the scope of proposed activities that will occur within RRs.

Table H-34. Acres of RR that are adjacent or within WSFR treatment units.

Treatment Type	WSFR Project Unit acres adjacent or within RRs
Fuels	6,206
Salvage Harvest	1,990
Hazard Tree Removal	5,684

1. Salvage Harvest and Reforestation

RRs have been established along all streams to protect water quality (for widths of RRs see PDF Watershed-3). Risks to sediment supply and delivery are discussed above under the Sediment habitat Indicator group. Cutting trees for salvage harvest will not occur within RRs, during any and all methods of removal (tractor, skyline and helicopter). Figure 3 displays an example of how RRs and other unstable areas will be excluded from salvage harvest. The acres of salvage harvest are shown above (Table 1) and indicate the amount of RRs that fall within harvest units. But salvage harvest itself will not occur within any RRs. Acres of RRs within or near units are listed in Table 34 because those areas represent a higher risk to water quality due to proximity to stream courses. Skyline yarding corridors that run parallel to streams will not occur within RRs and, in the rare instance when a corridor needs to cross a stream channel, full suspension (*i.e.*, saw logs are not allowed to touch the stream) is required (PDF Watershed- 29). A majority of units only have seasonal streams near or within them and trees in these treatment areas are burned. Acknowledging that standing dead trees do provide some shade to streams albeit short term, Project design provides for protection of standing trees along perennial streams. Therefore salvage harvest will not alter stream shade. Existing skyline yarding corridors will be reused when possible except where a less ground disturbing option is available. Because salvage harvest will not remove trees within RRs, salvage harvest will have insignificant effects on water quality and anadromous salmonid habitat and minor effects on Coho salmon.

Reforestation includes site-preparation, planting, and release of over 7,873 acres, to increase the likelihood and speed by which burned areas are reforested. Reforestation includes manual site preparation, skyline yarding, mastication, mechanical yarding and slash piling of dead trees. Treatments within RRs are limited to the Happy Camp and Whites fire areas in instances where moderate or high severity burned plantations overlap RRs. Proposed actions include lop and scatter of small dead trees and brush, accomplished by hand treatments. Site preparation and planting activities are proposed within salvage units and otherwise within plantations that burned at high or moderate severity. These treatments target plantations that were heavily burned during recent fires and are within units where ground-disturbing actions are proposed. The hand treatment is designed to provide near-term soil cover in locations where the natural buffering capacity of the RR has been reduced by fires. The treatment is likely to reduce short term erosion at the site level, and to help promote and encourage natural regeneration and soil recovery in the RRs treated.

Potential effects to chemical contamination associated with use of mechanized equipment for reforestation activities within RRs during site preparation will be minimized through implementation of Watershed PDF-27, which limits refueling to designated landings that are not hydrologically connected to streams and, as an added precaution, requires a spill containment kit to be on site.

Summary of Indirect Effects. Due to the following minimization measures: 1) site preparation activities within RRs will only occur in plantations (plantations have relatively young and smaller trees) and are solely designed to have beneficial effects to soil and vegetation recovery; 2) implementation of Watershed PDF-11, which limits removal of trees to those that are less than 8" in diameter when removal is needed to address fuels accumulations; 3) tree cutting and lop-scatter methods are limited to hand work; and 4) refueling is not allowed within RRs. Site preparation and reforestation is expected to have insignificant effects on the Water Quality habitat Indicator group and anadromous salmonid habitat, and minor effects on Coho salmon. Releasing over-crowded trees and reducing fuels within RRs will result in long-term beneficial effects because the remaining trees will grow to a larger size quicker and the severity of future fire may be reduced as a result of reduced fuels.

Proximity and Probability. Maps in Appendix A show that treatment units are in proximity to anadromous salmonid habitat. However, the probability of effects is insignificant, as described above.

2. Fuels Reduction

Table 34 above shows the extent of fuels treatments that will occur within or adjacent to RRs. Watershed PDFs for fuels treatments (33, 34, 35, and 36) have been designed to maintain stream shade, understory vegetation and water quality during fuels treatment within RRs. For example, within RRs, prescribed fire effects will mimic a low intensity backing fire, except for handpiles/windrows where higher intensity may occur to consume pile material. Fuels reduction activities are likely to reduce the severity of future fire events, particularly when fire occurs in the same area greater than 5 years in the future. Refer to the Sediment habitat Indicator group discussion above for a more detailed discussion of effects minimization measures.

Summary of Indirect Effects. Due to the Watershed PDFs that will implemented, and because shade canopy will not be affected by fuels treatment activities, fuels reduction actions will have insignificant effects on the Water Quality habitat Indicator group and anadromous salmonid habitat, and minor effects on Coho salmon.

Proximity and Probability. Maps in Appendix A and tables in Appendix B show that treatment units are in proximity to anadromous salmonid habitat. However, the probability of effects is insignificant, as described above.

3. Hazard Tree Abatement

Hazard trees will be removed from roadside areas as described above under the Sediment habitat Indicator group discussion above, including within RRs. The risk of effects to water quality and stream temperatures are where there are groups of hazard trees (especially if there are mature live trees) to be removed along roads that parallel to or repeatedly cross perennial streams. Removal of dead trees and individual hazard trees

that are not grouped will have no measurable effect on shade or stream temperatures. Based on field reviews and mapped hazard tree areas (see maps in Appendix A), removal of groups of hazard trees within RRs along perennial stream channels will not occur to an extent that will measurably reduce existing shade canopy. Many hazard trees designated for felling are burned, and now provide only near term and greatly reduced levels of shade to adjacent streams. The groups of hazard trees that will be removed are along short stretches of mostly non-fish bearing intermittent or ephemeral channels.

Summary of Effects. The highest risk of effects associated with hazard tree removal is where groups of trees, especially mature live trees, will be removed within RRs. The extent of removal of groups of trees is limited, based on hazard tree marking reviewed to this point. Hazard trees to be removed are burned or otherwise compromised and pose a safety hazard. Due to policy direction for administration of the road system, there isn't discretion as to whether to fell hazard trees. Based on review of hazard tree marking adjacent to streams, removal of hazard trees along roadsides will have insignificant effects on water quality and anadromous salmonid habitat, and minor effects on Coho salmon.

Proximity and Probability. Maps in Appendix A and tables in Appendix C show that treatment units are in proximity to anadromous salmonid habitat. However, the probability of effects is insignificant (extremely unlikely to occur), as described above.

4. Temporary Roads, Landings and Water Drafting

The proposed action includes approximately 16.4 miles of temporary road segments to access harvest units: 1.2 miles in the Beaver Fire; 14.3 miles in the Happy Camp Complex; and 0.8 miles in the Whites Fire. The total road mileage is divided among several short segments and all temporary roads will be hydrologically restored/stabilized after use. This hydrological stabilization includes: constructing waterbars; outsloping road prisms if appropriate; removing crossings; and obliterating access to the road.

There are a total of ~3.4 miles of proposed new temporary roads, consisting of many short segments proposed on ridgetops to facilitate skyline logging systems. These short spurs will create new alignments on the landscape however field review verified that all proposed new temporary road segments are outside of RR and not hydrologically connected to downstream fish habitat.

Roads can have a major impact on sediment and the drainage network. Temporary roads can affect water quality through increased sedimentation (discussed above under the Sediment indicator) or through alteration of stream shade associated with stream crossing construction or if construction of a temporary road occurs within RRs and tree removal is required. On existing road alignments, vegetation has previously been disturbed. None of the roads or stream crossings associated with project temporary roads require removal of shade trees along perennial streams. Watershed PDFs (5, 18 and 20) will be implemented to minimize other impacts. Temporary roads and stream crossings will have insignificant effects on the Water Quality habitat indicator group and anadromous salmonid habitat, and minor effects on Coho salmon.

Landing use and construction and potential effects to sediment are discussed above under the Sediment habitat Indicator group. Landings located within RRs represents one of the greatest risk to water quality because landings disturb vegetation in close proximity to

stream channels. The project has a risk of affecting water quality through construction or use of the following landings that are within RRs (see locations on map in Appendix A): Landings # DZ03, DZ10, DZ23, L043, L044, and L090). No trees providing effective canopy shade to streams will be removed as a result of landing use or construction. The following Watershed PDFs will be implemented to minimize effects of landings: existing landings will be used to the extent possible; existing landings in stream-course RRs will not be expanded towards stream channels or where vegetation providing shade to streams would need to be removed. Site reviews of all proposed landings to be constructed within RRs indicate that no shade trees would be removed and implementation of Watershed PDFs will effectively minimize impacts to water quality.

Water drafting can result in minor, short-term and localized decreases in flow, especially in smaller streams, affecting water quality. This is particularly true during drought conditions, which may occur during project implementation. However, NOAA specifications (2001) don't allow drafting volumes to exceed 10% of stream flow within fish-bearing streams, to allow for adequate downstream flow to support fish, aquatic insects, amphibians, and other biota. Project BMPs don't allow drafting volumes to exceed 50% of stream flow outside of CH. Additionally, KNF fish biologists will be consulted prior to water drafting operations so that they can ensure that sites with rearing Coho salmon are avoided and sites that are not suitable for fish (primarily due to high stream temperatures) are prioritized for use. Due to PDFs that have been designed to minimize drops in stream flow and associated changes to water quality (PDF 18), the requirement to adhere to NOAA's (2001) water drafting specifications and KNF BMPs, the proposed action will have insignificant effects on water quality and anadromous salmonid habitat, and minor effects on Coho salmon.

Heavy mechanized equipment will be utilized during construction of temporary roads and landings. The use of heavy equipment within RRs represents a risk to water quality because fuel or hydraulic fluid spills could occur. BMPs 2.8 and 2.11 of the Region 5 Forest Service BMP Handbook (USFS 2011), as well as the Watershed PDF-27 will be implemented to minimize the risk of spills. BMPs include requirements that equipment be properly maintained and cleaned, including daily inspections; fueling and servicing of equipment in designated areas outside of RR, with the exception of hydrologically disconnected project landings; having a spill plan in place prior to implementation; removal and disposal of leaks/spills; and requirement to have a spill kit on site. PDF-27 prohibits refueling within RRs except at designated landings in locations where they are disconnected from water features and requires that a spill containment kit be on site where refueling and servicing take place. Based on implementation of minimization measures, fuel spills are not expected and effects on the Water Quality habitat Indicator group and anadromous salmonid habitat will be insignificant, with minor effects on Coho salmon.

Summary of Indirect Effects. Based on BMPs, Watershed PDFs and other project design features that will minimize the potential adverse effects of roads and stream crossings on the Water Quality habitat Indicator group, and because none of the crossings will be within anadromous salmonid habitat, and all but 2 temporary road/stream crossings will be dry during construction and use, temporary roads and crossings will

have insignificant effects on the Water Quality habitat Indicator group and anadromous salmonid habitat, and minor effects on Coho salmon.

New landings within RRs have a high risk of impacts to the Water Quality habitat indicator group including to stream shade and chemical contamination. Although watershed-scale effects are expected to be insignificant, site-scale effects may not be insignificant. Therefore, the magnitude of site-scale effects will be discussed further.

The potential impacts of water drafting on the Water Quality habitat Indicator group is associated with fuel or oil spills near streams. BMPs and PDF-27 are expected to minimize the risk of a leak or spill such that effects on the Water Quality habitat Indicator group and anadromous salmonid habitat, and minor effects on Coho salmon.

Proximity and Probability. Maps in Appendix A show that treatment units are in proximity to anadromous salmonid habitat but outside of CH. The probability of effects is insignificant, as described above, with the exception of landing construction within RRs. Landings #DZ03, DZ10, DZ23, L043, L044, and L090 are within RRs, thus the magnitude of site-scale effects will be discussed below.

Magnitude: The proposed new landings in RRs were all reviewed in the field. Watershed specialists determined that no shade trees would be removed and that soil disturbance would be minimized. Watershed PDF 27 will prohibit refueling unless the landing is hydrologically disconnected. The magnitude of effects is limited in scope to landing #DZ03, DZ10, DZ23, L043, L044, and L090 and potential impacts will be minimized through implementation of BMPs and PDFs. The magnitude of effects to the Water Quality habitat Indicator group is insignificant. New landings in RRs will have insignificant effects on the Water Quality habitat Indicator group and anadromous salmonid habitat, and minor effects on Coho salmon.

5. Legacy Sediment Site Treatments

The potential for indirect effects to water quality is highest for culvert upgrades or passage projects that are within active stream channels that require disturbance to adjacent riparian vegetation. None of the culverts are within habitat accessible to anadromous salmonids or within CH, and most culvert upgrade sites will be dry during construction and use. The culvert projects will likely disturb streamside vegetation in localized areas where culverts are located, and to a limited extent on each side of roads outside of CH. However, this work will occur on existing road alignments, where vegetation has been previously disturbed or removed. Culvert upgrade work has been programmatically analyzed in the Klamath National Forest Facility Maintenance and Watershed Restoration BA (USFS 2004). Disturbance to streamside vegetation providing effective canopy shade will be limited in scope and minimized at each site through BMPs and Watershed PDFs (21-24).

The potential for indirect effects to Coho salmon from legacy sediment site repairs is highest for projects that are within or near CH. None of the culvert projects are within habitat accessible to anadromous salmonids. Most of the culvert projects are well outside of CH, however, six are within 300 feet of CH. The culvert upgrade projects will likely disturb streamside vegetation in localized areas outside of CH, and to a limited extent on each side of roads. However, this work will occur on existing road alignments, where vegetation has been previously disturbed or removed. Culvert upgrade work has been

programmatically analyzed in the Klamath National Forest Facility Maintenance and Watershed Restoration BA (USFS 2004). Disturbance to streamside vegetation providing effective canopy shade will be minimized at each site through BMPs and Watershed PDFs (21-24) and effects to the Water Quality habitat Indicator group and anadromous salmonid habitat will be insignificant, with minor effects to Coho salmon. All together, these legacy sediment site treatments will result in meaningful benefits water quality and fish habitat in Elk Creek watershed, as well as improved passage for aquatic organisms and watershed products.

Summary of Indirect Effects. Because this PE is not within anadromous salmonid habitat, these projects are expected to have insignificant effects to water quality and anadromous salmonid habitat, and minor effects to Coho salmon. Effects to Sediment are discussed above. Legacy site repair will result in long-term beneficial effects to Coho salmon and anadromous salmonid habitat through significant reductions in sediment sources (refer to information provided above under the Sediment habitat Indicator group). Long-term beneficial effects may also include prevention of road crossing failures and associated disturbance to vegetation at the site-scale and downstream.

Proximity and Probability. Maps in Appendix A and tables in Appendix B show that treatment units are in proximity to anadromous salmonid habitat but outside of CH. The probability of effects is insignificant.

Riparian Function

Key riparian functions include sediment retention (discussed above under the Sediment habitat Indicator group), stream shade (discussed above under the Water Quality habitat Indicator group), protection and development of channel morphological features (streambanks, floodplains and side channels) and large wood loading to stream channels. The following discussion is focused on effects to the following Riparian Function habitat indicators based on the potential for indirect effects from the PEs (see Methods section):

- Large Wood: Potential effects are associated with removal of trees within RRs associated with the following PEs: salvage and reforestation/site preparation, hazard tree removal, fuels reduction, temporary road and landing construction and legacy site treatments.
- Off-channel habitat and floodplain connectivity: These habitat indicators are not applicable to certain channel types (Rosgen types A, B, and G), which characterize many of the Action Area streams. Existing off-channel habitat and floodplain function and the potential for development of these features exists in low gradient, valley floor reaches. For example, in the lower 1.6 miles of Grider Creek there is potential for development of more off-channel habitat, however there has been channelization in this reach associated with the existing road to prevent flood damage. None of the PEs include channelization or other work within valley floor segments or floodplains within Analysis Area streams. The proposed action aims to provide protection to valley floor stream segments and floodplains though designation of RRs, inner gorges and other unstable areas, and by avoiding any modifications to streambanks or floodplains. Thus, the project will have neutral effects on off-channel habitat and floodplains.

The Analytical Process allows use of "efficiency measures" if there is no causal mechanism to affect an indicator. For these reasons, the off-channel and floodplain habitat indicator will not be discussed further.

- Streambank Condition: The Flood of 1997 and associated debris flows altered channel conditions in many of the Analysis Area streams including streambank conditions. Altered channels, streambanks and riparian vegetation are still recovering from the 1997 flood event. The potential for effects to this indicator are associated with activities that occur in the near-stream zone within RRs. Most of the PEs avoid this area with the exception of hazard tree removal (where this occurs along roads that cross or run parallel to streams), temporary road stream crossings/culvert installations, and legacy site treatments that include stream crossings.

Landscape-level changes to forested habitat occurred as a result of the 2014 wildfires. High fire intensity areas were characterized by total or near-total conifer crown consumption, resulting in severe impacts to riparian function in some areas. Within areas of moderate burn intensity, some crown consumption occurred, but generally these areas are characterized by total or near-total crown scorch. The vast majority of trees in these burned areas have been killed by the fire or damaged beyond their ability to survive. Within areas of light burn intensity only the smaller size and lower crown class conifers were burned.

The 2014 fires changed riparian function in a mosaic pattern across the landscape. Burned understory vegetation may recover quickly and fully re-establish in 20 years or so. Regrowth of large conifers will take much longer, at least 50 years. Within burned RRs, there will be an increase in large wood loading in the near-term, as burned trees fall and recruit to stream channels. There will be a reduction in large wood available for recruitment in the long-term, until large conifers and hardwoods re-establish. The process of regrowth and recruitment will occur at varying rates across the landscape, and burned areas will input large wood at different rates than adjacent unburned stands. Thus, a mosaic of different conditions are expected across the landscape over time.

The risk of impacts to riparian function is highest for actions that occur within RRs. As described above under the Water Quality section, FEMAT (1993) called for protection of two site potential tree heights or to the edge of the inner gorge and Spence et al. (1996) note that the absolute minimum buffer width is one site potential tree height. The proposed action includes RR widths of two site potential tree height along fish-bearing streams and one site potential tree height along non-fish bearing streams. RRs are protected from salvage harvest, but some proposed activities will occur within RRs and are the focus of this discussion. They are fuels treatment, hazard tree removal, roads/landings/stream crossings, and legacy site treatments. Watershed PDFs, as described below, will be implemented to minimize effects to riparian function.

A primary function of RRs is as a source for large wood recruitment to streams. Large wood plays a dominant role in forming pools, metering sediment, trapping spawning gravels and creating a more complex stream environment. In general, the larger the size of the wood, the greater its stability and duration in the stream channel. Heavier pieces require higher flows for mobilization and longer pieces are more likely to be caught by the stream bank and its vegetation (Spence et al., 1996). Large wood is important for

forming pools in lower order streams as well (Kelly et al., 1995; Bisson et al., 1987) and pieces that span the channel can create dam pools or form complex jams which make excellent cover for aquatic species. Much of the large wood entering stream channels does so through landslides and debris torrents during large storm events. The wood component of debris torrents forms log jams, which may retain sediment for several years, thereby protecting lower reaches of the stream from sediment impacts. Poole and Berman (2000) note that large wood jams can also force stream flows underground and that this connection with the hyporheic zone can help cool stream temperatures. Large wood in headwater areas may also prevent headward erosion of gullies and stream channels (Kelly et al., 1995). Where effects to large wood are predicted herein, potential effects to stream temperature and erosion are inferred through the aforementioned mechanisms.

1. Salvage Harvest and Reforestation

The primary risks to riparian function are associated with soil disturbance (discussed above under the Sediment Indicator), effects to stream shade and chemical contamination (discussed above under the Water Quality Indicator), and effects associated with removal of standing or down trees that provide various functions in RRs (e.g. soil retention and productivity, and large wood loading to streams).

RRs have been established along all streams to protect riparian function (see PDFs Watershed-3) including large wood sources. Cutting of trees for salvage harvest will not occur within RRs during any and all methods of removal/harvest (tractor, skyline and helicopter). For an example of how RRs and inner gorges will be identified and excluded from salvage harvest refer to earlier discussion around Figure 3. Refer to the Sediment Indicator discussion above for a discussion of watershed disturbance associated with the proposed action. Skyline yarding corridors will not impact riparian function, as existing corridors will be used where possible: unless a less ground disturbing option is available. Where skyline corridors are needed parallel to stream channels they will be placed outside of RRs.

Reforestation includes site-preparation, planting, and release over 7,873 acres to increase the likelihood and speed by which burned areas become reforested. Reforestation includes manual site preparation, skyline yarding, mastication, mechanical yarding and slash piling of dead trees. Treatments within RRs are proposed where existing heavily burned plantations overlap RRs in Happy Camp and Whites fire areas (approximately 1227 acres), and where safety of forest workers can be ensured. These RR treatments are limited to lop and scatter of small dead trees and brush, accomplished by hand. The effect of these actions would be increased near term ground cover which would improve the post-fire buffering capacity of RRs and promote quicker soil and vegetation recovery.

Summary of Indirect Effects. Because salvage harvest will not occur within RRs, salvage harvest will have insignificant effects on riparian function and anadromous salmonid habitat, and minor effects on Coho salmon.

Site preparation and reforestation will not occur in RRs. Hand treatments to lop and scatter small dead trees and brush may occur within RRs and has the potential to improve riparian function at the site level. Only hand treatment is allowed and only small trees

would be cut and small material lopped and scattered to achieve ground cover. Site preparation and reforestation outside of RRs are expected to have insignificant effects on riparian function and anadromous salmonid habitat and minor effects on Coho salmon. Lopping and scattering small material, releasing over-crowded trees, and reducing fuels within RRs will result in long-term beneficial effects to riparian function, anadromous salmonid habitat, and SONCC Coho salmon. Due to reforestation and release actions, trees are likely to grow to a larger size quicker than if no action were taken, and the severity of future fire may be reduced as a result of reduced fuels.

Proximity and Probability. Maps in Appendix A and tables Appendix C show that treatment units are within proximity to anadromous salmonid habitat. However, the probability of effects is insignificant because trees in RRs will not be removed.

2) Fuels Reduction Treatments

The risk of effects to riparian function is associated with soil disturbance (discussed above under the Sediment Indicator), effects to stream shade and chemical contamination (discussed above under the Water Quality Indicator), and effects associated with removal of standing or down trees that provide various functions in the riparian zone (soil retention and productivity and large wood loading to streams).

Fuels reduction through thinning small diameter trees in RRs will occur in the proposed roadside treatments and fuels reduction zones (see map in Appendix A). Thinning will remove smaller trees that represent a fuels hazard or ladder fuels. These actions will improve the growth rate of larger trees left on site, thereby improving riparian function relative to stream shade, microclimate and large wood loading in the future. Overstocked conditions prevent or retard the attainment of mature stands and desired conditions within RRs – and the crowded, small diameter trees targeted for removal will likely not reach desired size for providing stream shade or recruitment to streams. Watershed PDF 37 requires that prescribed fire retain at least 90% of the down and standing large woody debris in RRs to protect soil productivity, soil retention capacity and large wood loading to stream channels. Some small localized flareups could occur in pockets where fuel accumulations are high but overall, prescribed fire actions are designed to minimize adverse effects on riparian function and to make stands more resilient to wildfire. Effects to Sediment associated with mastication and other ground disturbance are discussed above under the Sediment Indicator.

Summary of Indirect Effects. Due to the Watershed PDFs that will be implemented to minimize effects to riparian function (primarily the requirement to maintain key standing and down large wood pieces, and to only thin small diameter trees), fuels reduction actions will have insignificant effects on riparian function and anadromous salmonid habitat, and minor effects on Coho salmon.

Proximity and Probability. Maps in Appendix A and tables Appendix B show that treatment units are in proximity to anadromous salmonid habitat. However, the probability of effects is insignificant primarily because of the requirement to maintain key standing and down large wood pieces, and to limit thinning to small diameter trees.

2. Hazard Tree Removal

Hazard trees will be removed from roadside areas, including within RRs. The risk of effects to riparian function is associated with soil disturbance (discussed above under the

Sediment Indicator), effects to stream shade (discussed above under the Water Quality Indicator), and effects associated with removal of standing or down trees that provide various functions in the riparian zone (soil retention and productivity and large wood loading to streams).

Table 35 displays miles of hazard tree removal that are proposed within 175 feet from SONCC Coho CH by watershed. Critical Habitat reaches of lower East Fork Elk Creek, Elk Creek, Walker Creek, China Creek, Tompkins Creek, North Russian Creek, and Whites Gulch, along with several reaches of the middle Klamath River, may be affected by this action.

Table H-35. Miles of roadside hazard removal within 175 feet of CH.

Fire area	5th Field watershed	Hazard Tree Removal Miles Within 175 feet of Coho CH
Beaver	Beaver Creek	1.7
	Horse Creek-Klamath River	1
	Humbug Creek-Klamath River	4.6
Happy Camp	Elk Creek	4
	Lower Scott River	4.1
	Seiad Creek-Klamath River	3.4
	Thompson Creek-Klamath River	2.1
Whites	North Fork Salmon	8.3
Total		29.2

Especially where roads proposed for hazard tree removal are parallel to, and within RR associated with SONCC Coho salmon CH streams (listed above Table 35), it is important that any trees below the road that are deemed a hazard to the road will be felled toward the stream channel, and any tree larger than 26 inches DBH will not be removed. The following Watershed PDFs will be implemented to minimize effects: Watershed-14 requires that all hazard trees cut within 25 feet of stream channels, including fish/bearing stream channels, be left on site unless they pose a safety hazard; all hazard trees that are 26 inches or greater in diameter at breast height, must be left on site, unless they pose a safety hazard; Watershed-16 prohibits trees from being cut that are on streambanks; Watershed-17 requires directional felling to protect streambanks. Most of the hazard trees along roads within the three burned areas are burned or otherwise compromised and pose a safety hazard, thus there is not discretion with regard to felling/removal.

Summary of Effects. Watershed PDFs will help maintain key riparian functions such as standing and down large wood (*i.e.*, felled trees will be left on site within the recruitment zone along streams to protect soil productivity, sediment retention and large wood loading) retention after hazard tree removal. Thus, hazard tree removal will have insignificant effects to riparian function and anadromous salmonid habitat, and minor effects to Coho salmon.

Proximity and Probability. Maps in Appendix A and tables Appendix C show that treatment units are in proximity to anadromous salmonid habitat. However, the probability of effects is insignificant primarily because felled trees will be left on site within the recruitment zone along streams wherever safety concerns permit, to protect soil productivity, sediment retention and large wood.

3. Roads, Landings and Water Drafting

The proposed action includes approximately 16.4 miles of temporary road segments to access harvest units: 1.2 miles in the Beaver Fire; 14.3 miles in the Happy Camp Complex; and 0.8 miles in the Whites Fire. The total road mileage is divided among several short segments, and all temporary roads will be hydrologically restored/stabilized after use, including: constructing waterbars; outsloping road prisms if appropriate; removing crossings; and obliterating access to the road.

Approximately 3.4 miles of proposed temporary roads will create new road bed alignments. Field review confirmed that new temporary roads are proposed as short segments, generally on ridgetops, that would facilitate skyline logging systems. All of these new temporary road alignments are well outside of riparian areas and construction, use, and hydrologic stabilization of these segments would not impact riparian function or threaten downstream water quality.

Temporary roads can affect riparian function through increased sedimentation (discussed above under the Sediment indicator) or through disturbance within near-stream zones associated with stream crossing construction, or if construction of a temporary road occurs within RRs. Large wood will not be affected at crossings on existing road alignments as these areas have been previously disturbed and cleared. The following minimization measures and project designs features will be implemented to minimize effects to riparian function at all stream crossings: 1) none of the stream crossings are within fish-bearing habitat; 2) none of the alignments require removal of shade trees along perennial streams; and 4) Watershed PDFs (5, 18 and 20) will be implemented to minimize site effects.

Landing use and construction and potential effects to sediment are discussed above under the Sediment habitat Indicator group. Landings located within RRs represents one of the greatest risks to riparian function because landings routinely disturb soil and vegetation in close proximity to stream channels. The proposed action has a high risk of affecting riparian function at the site-scale through construction of the following landings that are within RRs (see locations on map in Appendix A): Landings # DZ03, DZ10, DZ23, L043, L044, and L090.

Based on site reviews of all proposed new landings within RRs, the fact that no large conifers would be removed, and that Watershed PDFs will be implemented that are designed to minimize impacts to riparian function (existing landings will be used to the extent possible; existing landings in stream-course RRs will not be expanded towards stream channels or where trees that provide shade to streams would need to be removed), use or construction of landings will have insignificant effects on riparian function and anadromous salmonid habitat, and minor effects to Coho salmon.

Water drafting can result in impacts to riparian function if new sites are developed or existing sites are modified. Watershed-38 and 39 require that only existing developed water drafting sites be used and that the only modifications allowed to sites within Coho salmon CH is the rocking of approaches to minimize sedimentation. Due to PDFs and BMPs (described above under the Sediment and Water Quality indicators) that have been designed to minimize effects, water drafting will have insignificant effects on riparian function and anadromous salmonid habitat, and minor effects to Coho salmon.

Summary of Indirect Effects. General project design features, BMPs and Watershed PDFs (*e.g*. none of the stream crossings are within fish-bearing habitat, stream crossings are mostly limited to intermittent or ephemeral streams that will be dry during construction and use, and none of the road alignments require removal of shade trees/large wood along perennial streams) will be implemented to minimize impacts. Thus, temporary road construction and stream crossings will have insignificant effects on riparian function and anadromous salmonid habitat, and minor effects on Coho salmon.

At the watershed-scale, landings will have insignificant effects to riparian function because they are small areas of disturbance interspersed with undisturbed zones. General project design features guide locations, avoid unstable areas and require use of existing landings whereever possible. BMPs and PDFs have been designed to minimize impacts. Thus, at the watershed-scale, landing use and construction will have insignificant effects on riparian function and anadromous salmonid habitat, and minor effects on Coho salmon. However, at the site-scale, landings have a high risk of adverse effects when constructed within RRs (Landings # DZ03, DZ10, DZ23, L043, L044, and L090). Thus, the magnitude of this effect will be discussed further below.

Magnitude: All proposed new landings in RRs were reviewed in the field. The magnitude of potential effects is limited in scope to landing #DZ03, DZ10, DZ23, L043, L044, and L090. The criteria for use of existing landings are: existing landings in RR will not be expanded towards stream channels, or on to active landslides, or where vegetation that provides shade to a stream would need to be cut. Existing landings in RRs will be shaped and treated for erosion control at the end of each season of use, and hydrologically restored at project completion (including subsoiling and covering with slash/mulch as needed). Reused landings in RRs will have site specific erosion control measures to reduce risk of sediment delivery into streams.

Site review of all new landings proposed within RR confirmed that these criteria (PDF Watershed-23) and other PDFs, along with proper implementation of BMPs, would be sufficient to avoid any meaningful negative effect(s) to anadromous fish habitat. The magnitude of effects to the Riparian Function habitat Indicator group and anadromous salmonid habitat is insignificant, with minor effects on Coho salmon.

4. Legacy Site Treatments

The potential for indirect effects to riparian function is highest for projects that are within or near active stream channels. None of the culvert upgrade projects are within habitat accessible to anadromous salmonids. Most of the culvert projects are well outside of CH, however six are approximately 300 feet from CH. The culvert upgrade projects will likely disturb streamside vegetation in localized areas where culverts are located, and to a limited extent on each side of roads. However, this work will occur on existing road alignments, where vegetation has been previously disturbed or removed. Thus, only early seral stage vegetation will be disturbed. Culvert upgrade work has been programmatically analyzed in the Klamath National Forest Facility Maintenance and Watershed Restoration BA (USFS 2004). Disturbance to streamside vegetation will be minimized at each site through BMPs and Watershed PDFs (21-24). All together, these legacy sediment site treatments will result in meaningful long term benefits to riparian function in the Elk Creek watershed.

Summary of Indirect Effects. Because these project activities are not within anadromous salmonid habitat or CH, these project activities are expected to have insignificant effects to riparian function and anadromous salmonid habitat, and minor effects to Coho salmon. Long term effects include improved riparian function and reduced road-related threats to water quality. Effects to sediment have been discussed above.

Proximity and Probability. Maps in Appendix A show that treatment sites are not within anadromous salmonid habitat. As described above under the sediment discussion, there are six culvert projects that are approximately 300 feet of CH (Upper East Fork Elk Creek and Cougar Creek-Elk Creek). However, these sites are at existing road crossings that have been previously disturbed and no large trees eligible for recruitment to streams would be removed. The probability of effects to riparian function is insignificant, as described above. The legacy sediment site work will result in benefits to riparian function in the long-term as crossings are upgraded to handle larger flood events and the potential for major flood disturbance induced by undersized crossings is reduced.

VIII. Cumulative Effects

The ESA defines cumulative effects in 50 C.F.R. 402.02 as "those effects of future State or private activities, not involving Federal Activities that are reasonably certain to occur within the Action Area of the Federal action subject to consultation." The AP (on page 42) explains that, "if the effect determination is NLAA, an assessment of ESA cumulative effects is not required by the regulations…." However, the following information is provided for added perspective.

The KNF uses standardized Cumulative Watershed Effects (CWE) models (Equivalent Roaded Area, Universal Soil Loss Equation, Mass Wasting) to assess effects of past, present, and reasonably foreseeable activities. The WSFR Hydrology Report affected environment analysis includes the following projects within the Analysis Area: Eddy Late Successional Reserve, Elk Thin, Fish Meadows, Glassups Timber Sale, Happy Camp Fire Protection Phase 2, Johnny O'Neil Late Successional Reserve Habitat Restoration and Fuels Reduction, Lake Mountain Foxtail Pine, Lower Scott Roads, North Fork Roads Storm-proofing, Oak Flat Thin, Singleton, Thom Seider Vegetation Management and Fuels Reduction, Two Bit Vegetation Management projects, work done under the Burned Area Emergency Response, grazing allotments, Timber Harvest Plans since 2005, and private land salvage (under Emergency Timber Harvest Plans). These are on-going activities and the CWE model includes them in the "current" portion of the results.

The CWE models reflect that there will be no increase in disturbance at the 5th-field watershed scale, and only minor incremental increases at the 7th field watershed scale (and short term disturbance at sites), due to project actions. As described in this analysis, at the watershed and site scale, Project effects to SONCC Coho salmon are either discountable (extrememly unlikely to occur), or insignificant (not meaningful). Therefore, cumulative impacts from adding the effects of the proposed action to present and reasonably foreseeable future actions are insignificant.

Of note is that during several Project field visits from November 2014 to March 2015, private timber harvest and associated road activities in the Beaver Fire area (Beaver, Doggett, and Kohl creek drainages) were observed to be causing sediment mobilization

to streams downslope in Beaver and Doggett Creeks. This project proposes only minor amounts of ground disturbing activities in these watersheds (total of 350 acres of salvage, 1700 acres of site prep and plant, and 0.8 miles of temporary road on existing road bed in the Beaver Fire area), and project actions will help restore late seral vegetation quicker on the acres treated, when compared to no action. Even so, short term insignificant effects to the sediment regime due to this project could be viewed as additive to these ongoing sediment-related impacts from private land activities. However, due to the low level of impact caused by this project (no salvage harvest in RR, minimal new infrastructure proposed, and minor acreage of ground disturbance in these watersheds), the influence of these effects to the sediment regime in Beaver, Doggett and Kohl creeks, and in the mid Klamath River constitutes a minor and insignificant impact to Coho salmon and their CH.

Future Federal actions that have not already been consulted on will be analyzed through separate Section 7 consultations.

IX. Effects Summary

The Analytical Process requires that BAs provide a summary statement for each PE. A summary of project effects by Project Element and by 2014 fire area is in Appendix G.

Once a PE summary is provided (above), the AP requires that BA's use a Project Effects Determination Key to answer questions based on the Indicator summary conclusions at the ESA action area scale, as follows:

PROJECT EFFECTS DETERMINATION KEY FOR SPECIES AND DESIGNATED CH

1) Do any of the Indicator summaries have a positive (+) or negative (-) conclusion?
   Yes – Go to 2
   No – No Effect
2) Are the Indicator summary results only positive?
   Yes – NLAA
   No – Go to 3
3) If any of the Indicator summary results are negative, are the effects insignificant or discountable?
   Yes – NLAA
   No – LAA, fill out Adverse Effects Form

X. Effects Determinations

Taking all analysis into consideration, at the ESA action area scale, it is the determination of the Fisheries Biologists that <u>the WSFR may affect, but is not likely to adversely affect SONCC Coho salmon or its designated CH.</u>

KNF stream surveys, California Department of Fish and Wildlife information and professional judgment of fisheries biologists has been compiled into the KNF steelhead trout distribution layer in the KNF Geographic Information Systems electronic library. The use of the KNF steelhead trout distribution to define SONCC Coho salmon and UKTR spring and fall-run Chinook salmon EFH is a conservative estimate of the distribution of SONCC Coho salmon and UKTR Chinook salmon because their distribution is less extensive than steelhead trout. For the Project, EFH is considered synonymous with steelhead distribution.

The effects analysis considers effects to Pacific salmonid habitat in general; and since habitat requirements for Coho and Chinook salmon are similar, the effects of the Project as described above for Coho salmon CH are similar for EFH.

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Fisheries Biological Assessment: Appendices

Appendix A. Project maps – 7 total, 6 maps of fire areas with proposed actions and 1 map of proposed legacy sediment site repair in Elk Creek Watershed.
Appendix B Detailed tables of proposed activities and CWE model outputs
Appendix C. KNF Table of Population and Habitat Indicators
Appendix D. Environmental Baseline and Effects Checklists, 5th and 7th field watersheds
Appendix E. Project Design Features, Best Management Practices and Wet Weather Operation Standards
Appendix F. Life history and biological requirements of Pacific Salmonids
Appendix G. Summary of Project Element Effects to Coho Salmon, and Critical Habitat, by 2014 Fire Area

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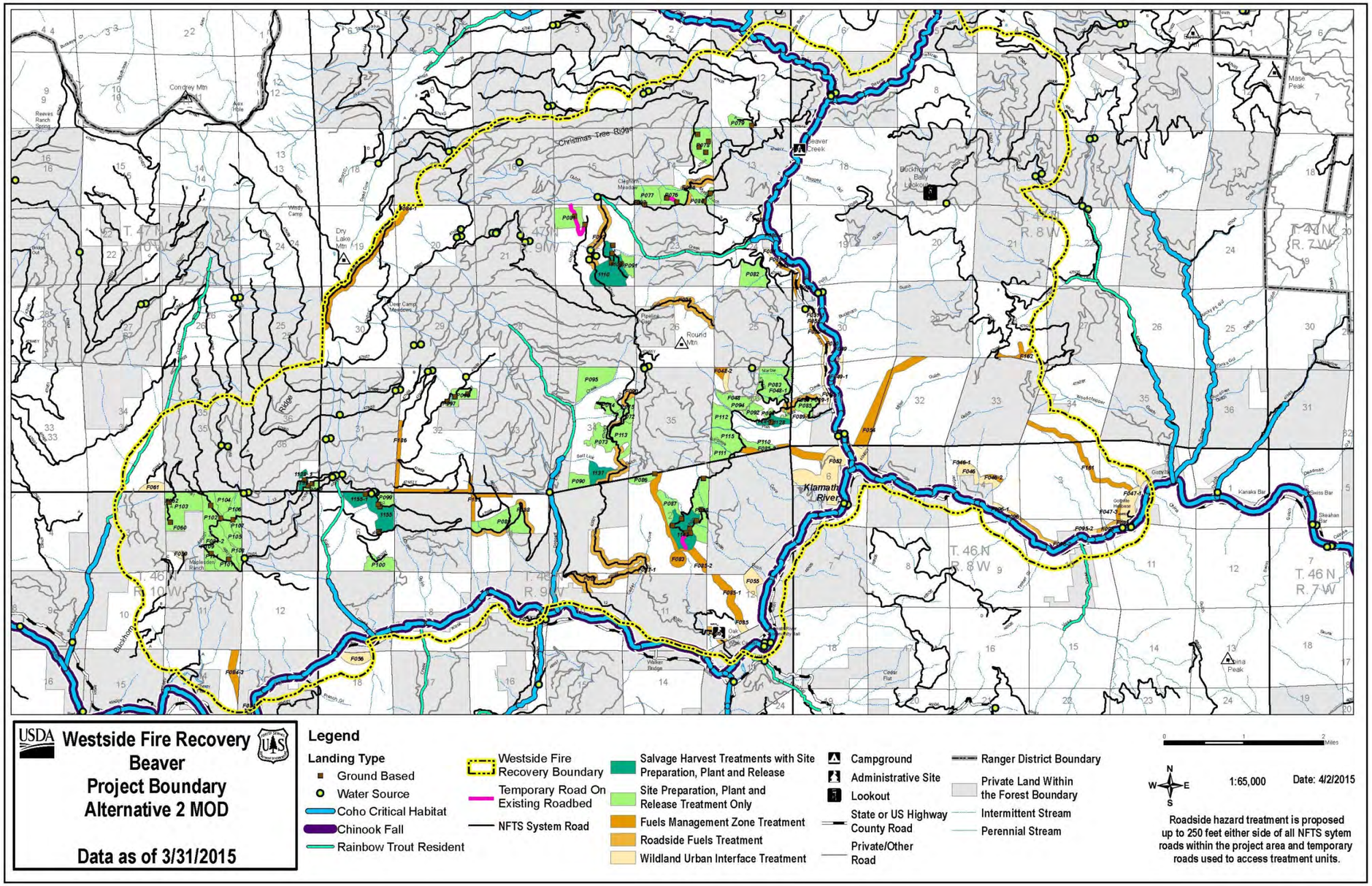

Map H-1: Alternative 2 Modified—Beaver Project Maps Submitted with the Fisheries Biological Assessment

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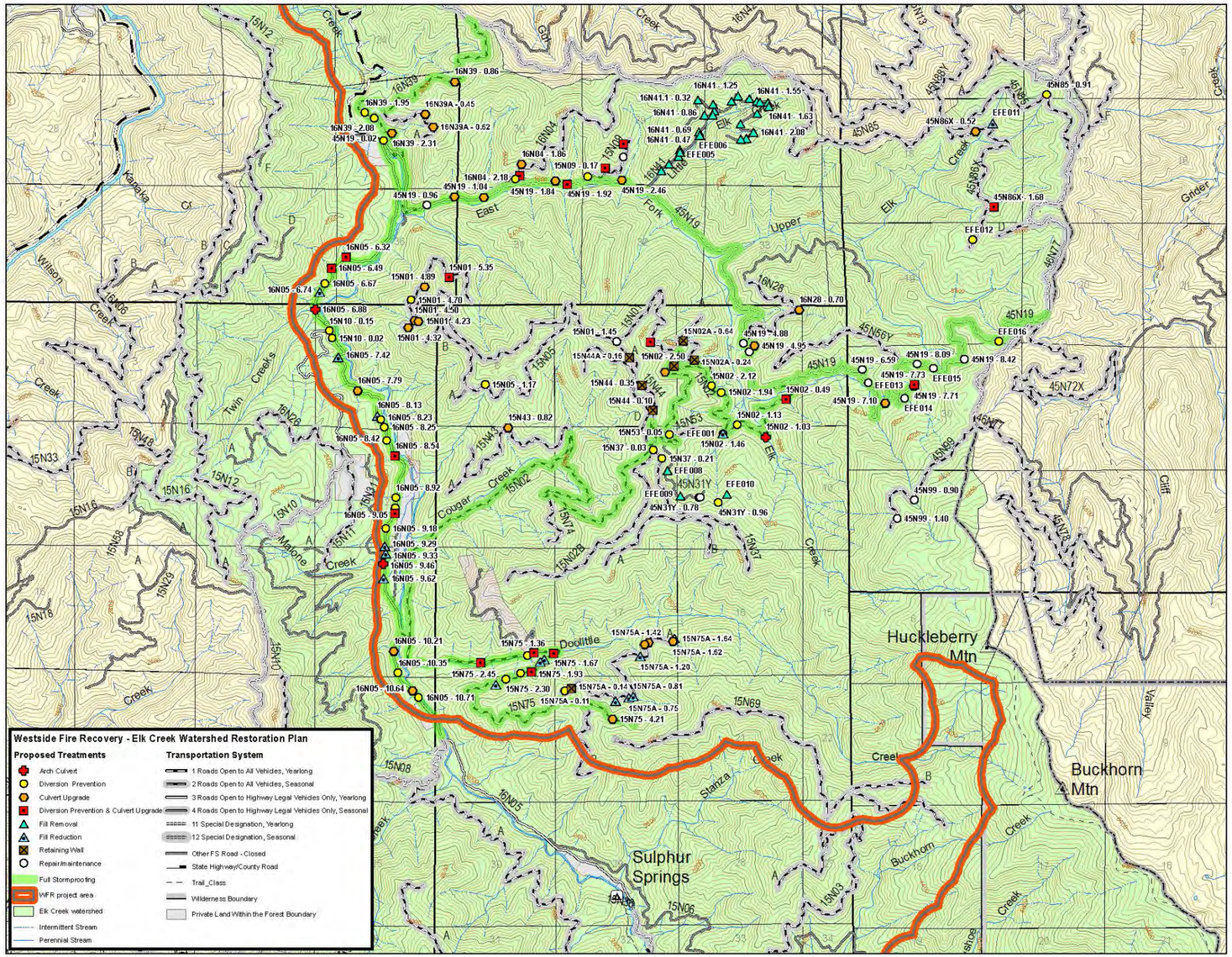
Westside Fire Recovery - Elk Creek Watershed Restoration Plan
Proposed Treatments
Arch Culvert
Diversion Prevention
Culvert Upgrade
Diversion Prevention & Culvert Upgrade
Fill Removal
Fill Reduction
Retaining Wall
Repair/Maintenance
Full Stormproofing
WFR project area
Elk Creek watershed
Intermittent Stream
Perennial Stream
Transportation System
1 Roads Open to All Vehicles, Yearlong
2 Roads Open to All Vehicles, Seasonal
3 Roads Open to Highway Legal Vehicles Only, Yearlong
4 Roads Open to Highway Legal Vehicles Only, Seasonal
11 Special Designation, Yearlong
12 Special Designation, Seasonal
Other FS Road - Closed
State Highway/County Road
Trail_Class
Wilderness Boundary
Private Land Within the Forest Boundary
Huckleberry Mtn
Buckhorn Mtn
Sulphur Springs
Upper Elk
East Fork
Doolittle
Cougar Creek
Twin Creeks
Malone Creek
Wilson Creek
Kapetka Cr
Stanza Creek
Buckhorn Creek
Cliff Creek
Grider Creek
Valley Creek

Map H-2

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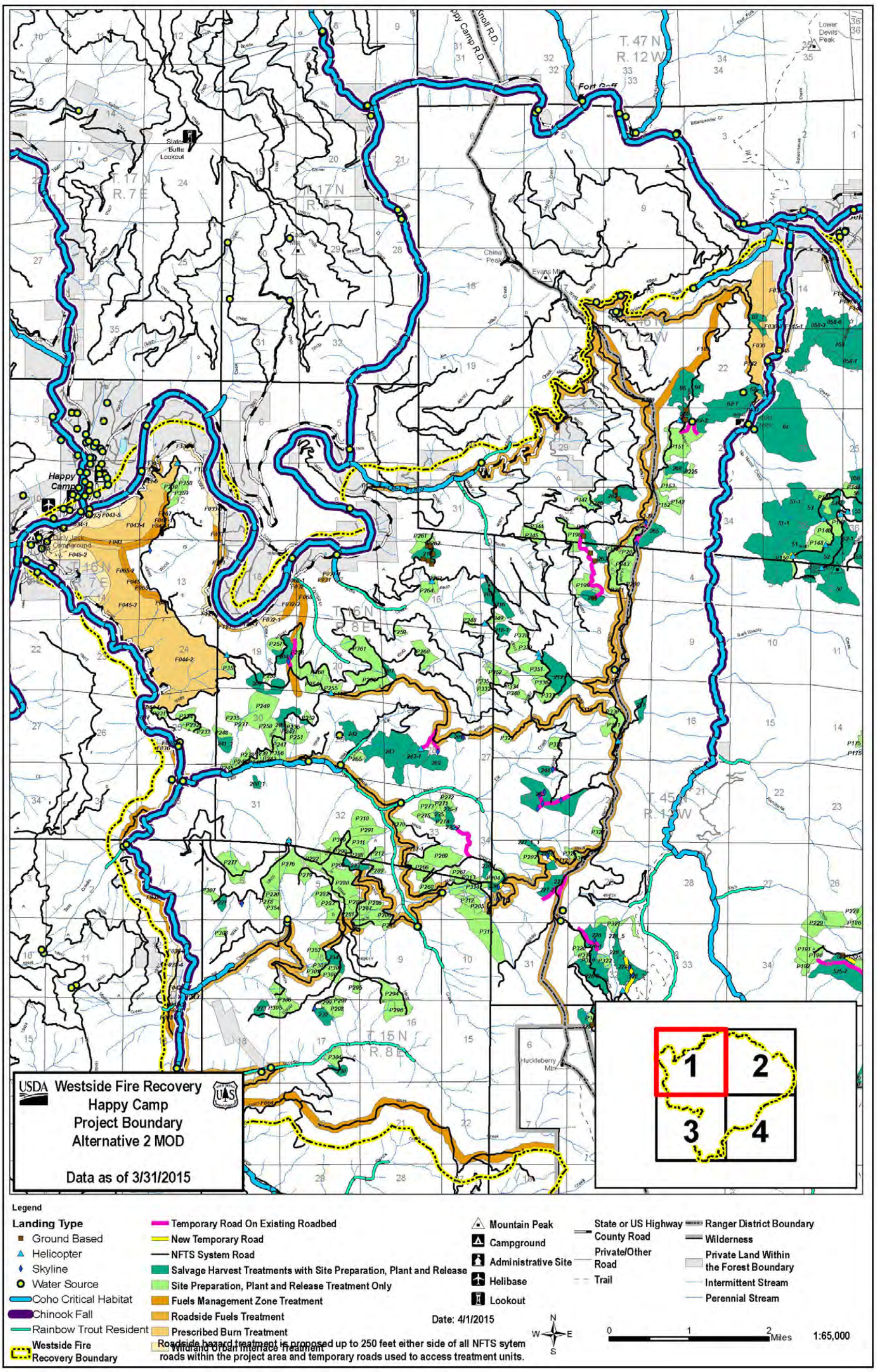

Map H-3: Alternative 2 Modified—Happy Camp (northwest) Project Maps Submitted with the Fisheries Biological Assessment

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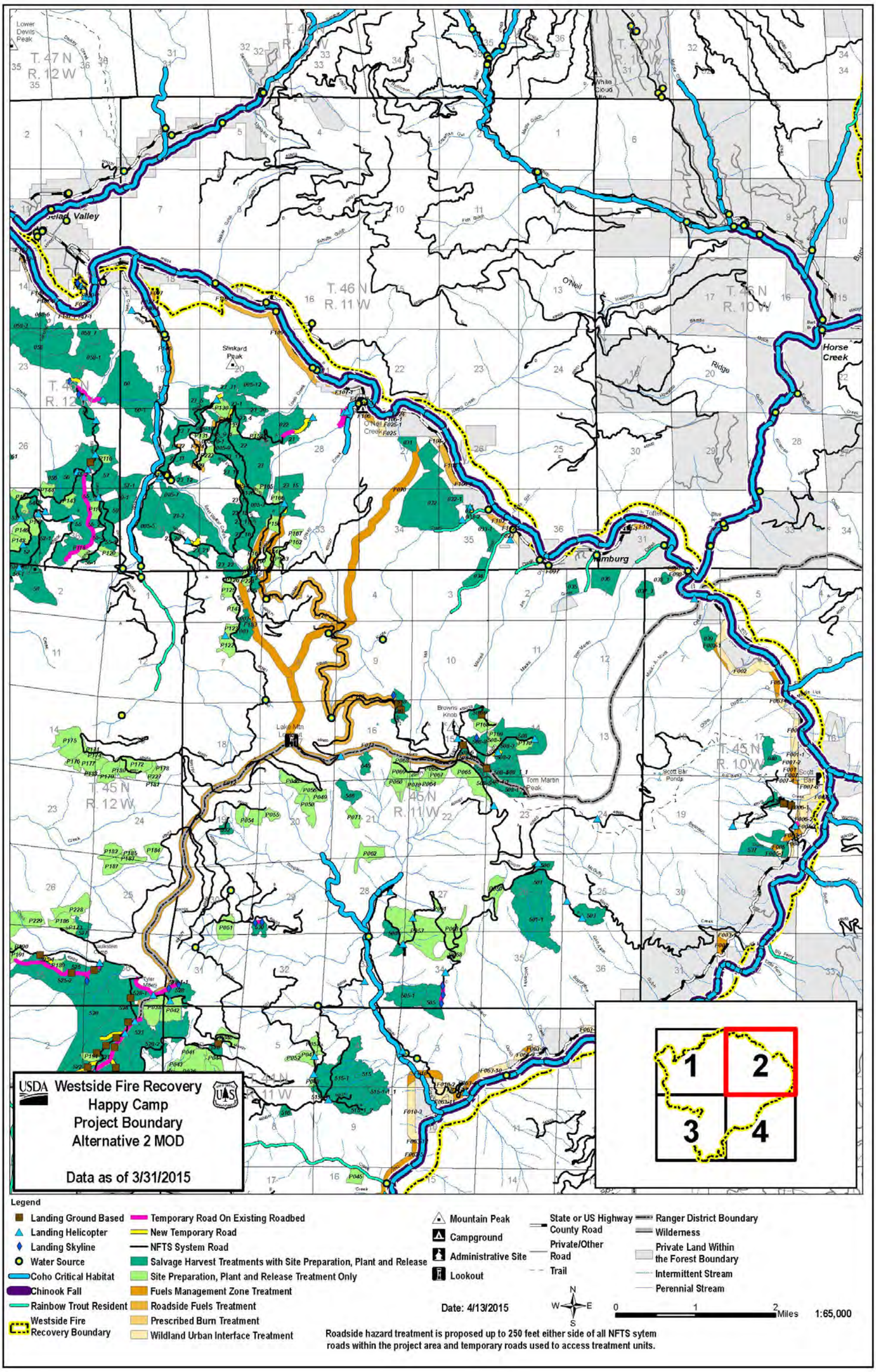

Map H-4: Alternative 2 Modified—Happy Camp (northeast) Project Maps Submitted with the Fisheries Biological Assessment

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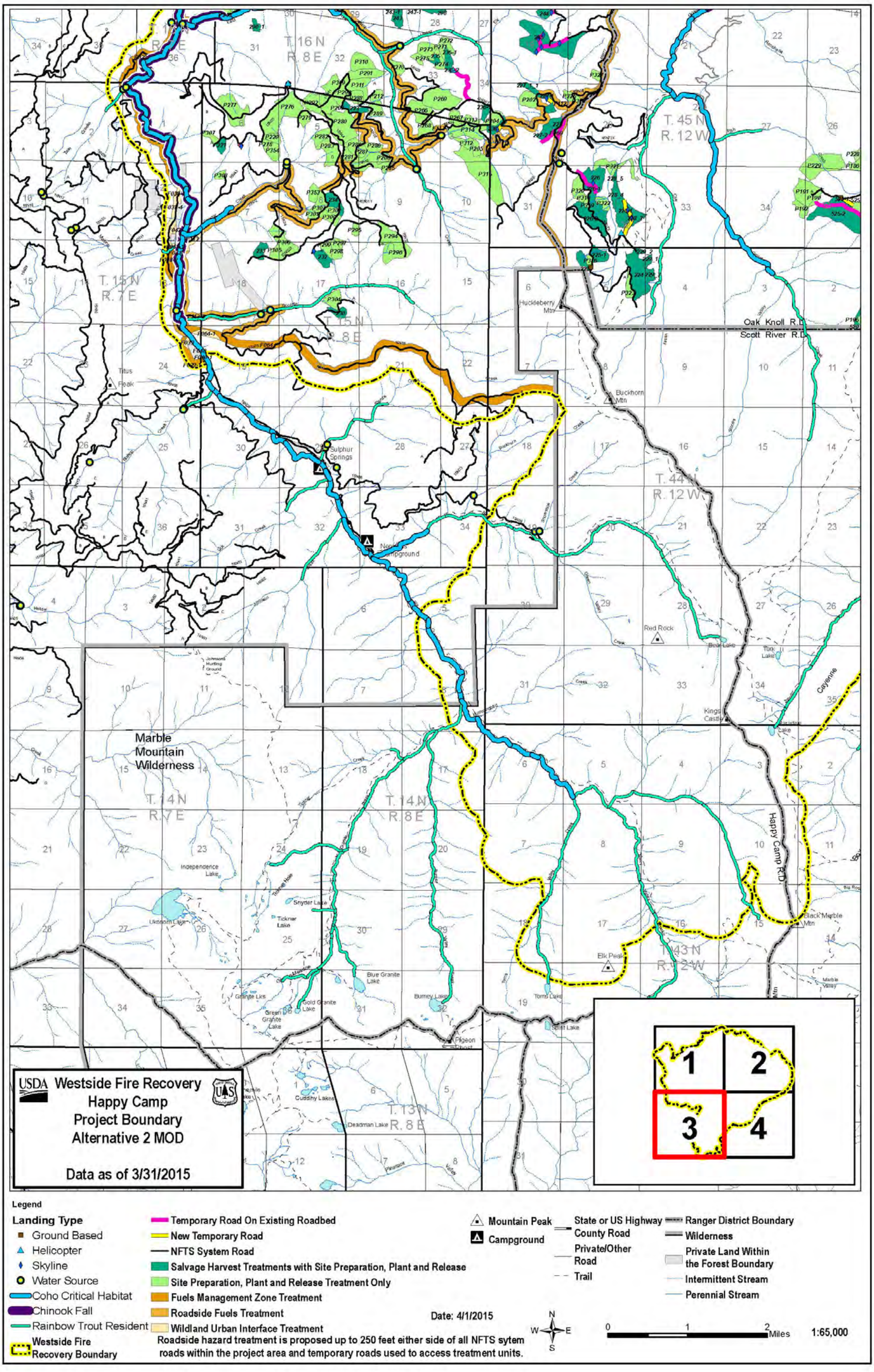

Map H-5: Alternative 2 Modified—Happy Camp (southwest) Project Maps Submitted with the Fisheries Biological Assessment:

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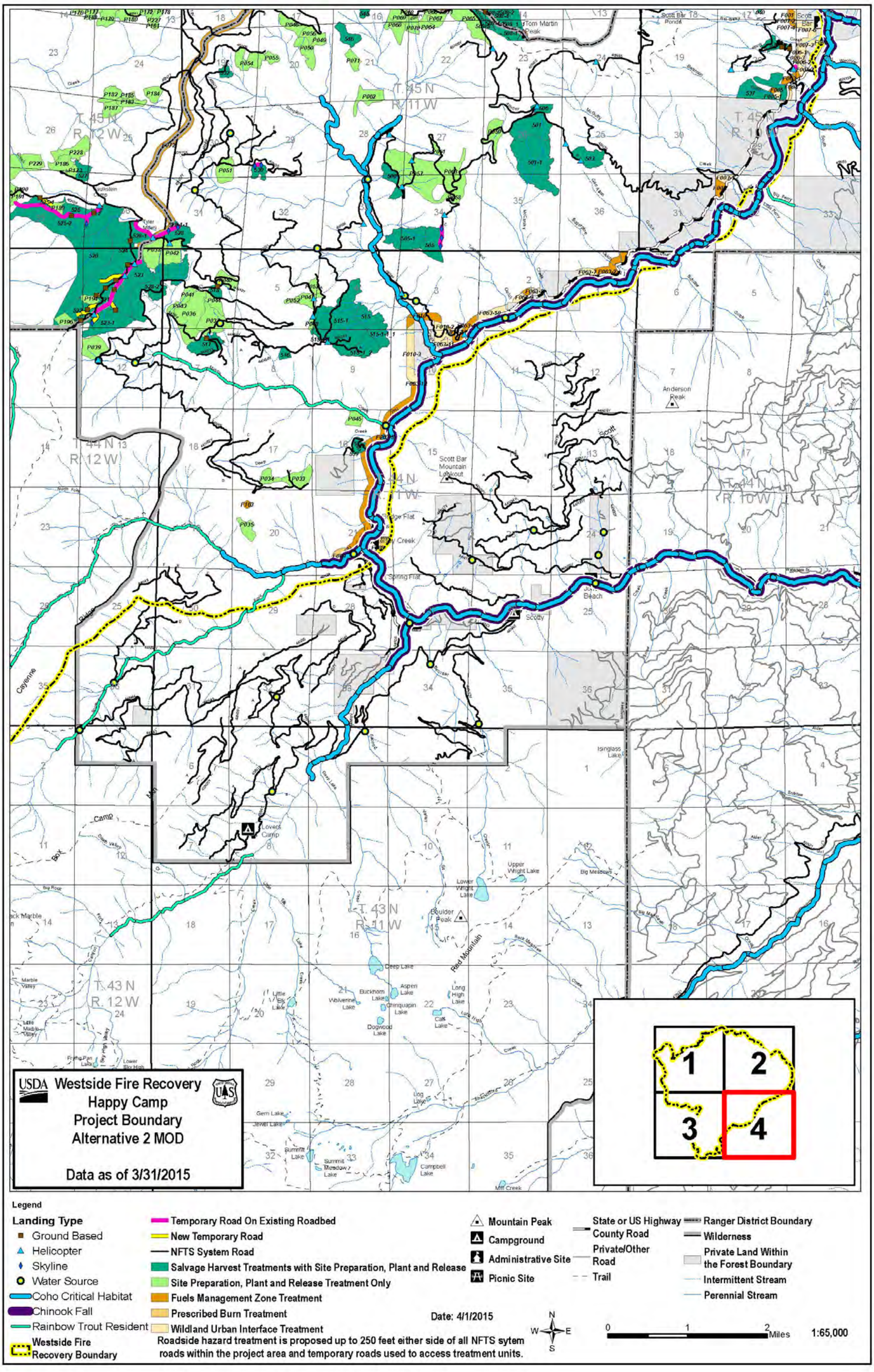

Map H-6: Alternative 2 Modified—Happy Camp (southeast) Project Maps Submitted with the Fisheries Biological Assessment

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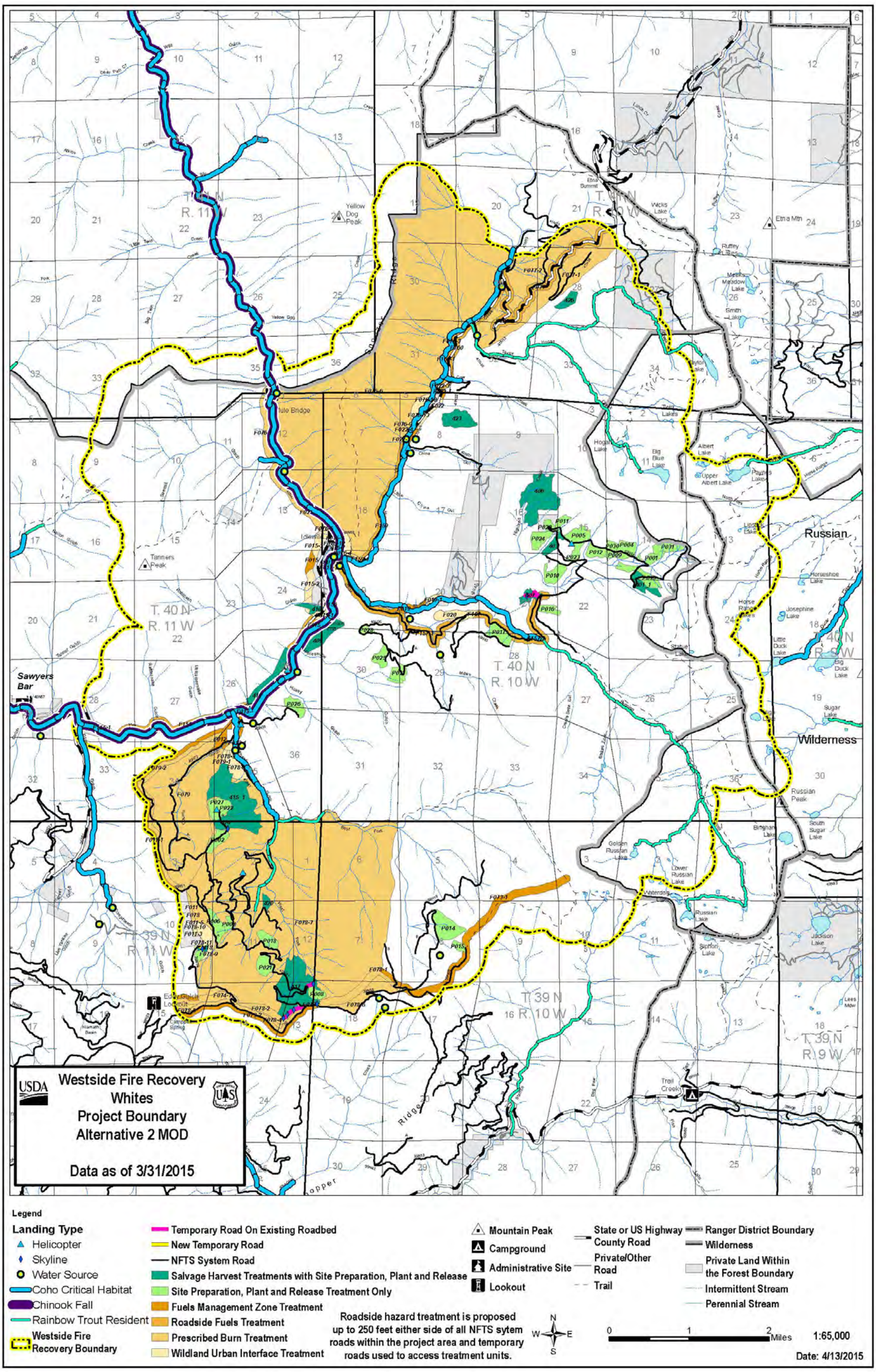

Map H-7: Alternative 2 Modified—Whites Project Maps Submitted with the Fisheries Biological Assessment

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Appendix B: Detailed Project Tables

Table H-36. Temporary road construction by 7th field watershed (all are outside of RR).

7th Field Watershed	Miles of New Temporary Road
Caroline Creek-Klamath River	0.12
Cliff Valley Creek	0.48
Cougar Creek-Elk Creek	0.04
Lower Grider Creek	0.09
Middle Creek	0.24
O'Neil Creek	0.43
Schutts Gulch-Klamath River	0.18
Shadow Creek	0.04
Tom Martin Creek-Klamath River	0.29
Upper East Fork Elk Creek	0.08
Upper Elk Creek	0.06
Upper Grider Creek	0.85
Walker Creek	0.46
Whites Gulch	0.06
Grand Total	**3.43**

Table H-37. Acres of Happy Camp fire area with proposed RR site preparation hand treatments by 7th field watershed (none proposed in Beaver Fire).

7th Field Watersheds	Acres of RR within site prep and plant units
China Creek	57.54
Cliff Valley Creek	39.72
Cougar Creek-Elk Creek	78.53
Deep Creek-Scott Creek	10.48
Doolittle Creek	24.76
Fryingpan Creek-Klamath River	37.12
Hoop&Devil-Elk Creek	23.51
Horse Creek	56.22
Lower East Fork Elk Creek	149.85
Lower Grider Creek	62.85
McCarthy Creek-Scott River	24.61
Middle Creek	106.99
North Fork Kelsey Creek	0.99
O’Neil Creek	11.57
Rancheria Creek	23.61
Schutts Gulch-Klamath River	2.92
South Fork Kelsey Creek	1.68
Tom Martin Creek-Klamath River	8.40
Tompkins Creek	133.10
Upper East Fork Elk Creek	192.32
Upper Elk Creek	20.93
Upper Grider Creek	15.85
Walker Creek	33.93
Total	1112.5

Table H-38. Acres of Whites Fire with proposed hand treatments in RR by 7th field watershed (none proposed in Beaver Fire).

7th Field Watersheds	Acres of RR within site prep and plant units
Music Creek	48.48
Robinson Gulch-North Fork Salmon River	10.71
Upper South Russian Creek	12.97
Whites Gulch	55.01
Total	127.17

Table H-39. CWE model outputs reflecting effects of Consultation Action by 5th field watershed.

5th Field Watershed	2014 Fire	Drainage Area (acres)	ERA Risk Ratio	USLE Risk Ratio	GEO Risk Ratio
Humbug Creek-Klamath River	Beaver	68023	0.31	0.58	0.85
Beaver Creek	Beaver	69610	1.02	1.11	1.01
Horse Creek-Klamath River	Beaver	98625	0.73	0.81	0.92
Seiad Creek-Klamath River	Happy Camp Complex	81706	0.56	0.32	0.70
Indian Creek-Scott River	Happy Camp Complex	76548	0.60	0.76	0.78
Lower Scott River	Happy Camp Complex	98016	0.55	0.41	0.64
Thompson Creek-Klamath River	Happy Camp Complex	67301	0.43	0.24	0.56
Elk Creek	Happy Camp Complex	60829	0.51	0.52	0.53
Ukonom Creek-Klamath River	Happy Camp Complex	87884	0.39	0.22	0.53
South Fork Salmon River	Whites	185597	0.31	0.27	0.47
North Fork Salmon River	Whites	130545	0.34	0.30	0.68

Table H-40. ERA model outputs showing current condition and effects of Consultation Action by 7th field watershed.

7th Field Watershed	2014 Fire	Drainage Area (acres)	Current ERA Risk Ratio	ERAs Fire, Salvage, Site Prep	ERA temp roads	ERA legacy Sites	ERA Risk Ratio	Change in ERA from Action
Bear Creek	Beaver	4219	0.76	0.0			0.76	0.00
Buckhorn Creek	Beaver	9118	0.95	12.3			0.97	0.02
Buckhorn Gulch-Beaver Creek	Beaver	8234	1.11	27.1			1.14	0.03
Collins Creek-Klamath River	Beaver	7845	0.41	7.5			0.42	0.01
Doggett Creek	Beaver	7701	2.36	17.6			2.39	0.03
Dona Creek-Klamath River	Beaver	4380	0.89	5.9			0.90	0.01
Dutch Creek	Beaver	6386	0.70	0.0	0.4		0.70	0.00
Dutch Creek	Beaver	3827	1.46	25.3			1.54	0.08
Jaynes Canyon	Beaver	7009	1.16	1.1			1.17	0.00
Kohl Creek	Beaver	3537	1.57	10.1	0.1		1.61	0.03
Little Humbug Creek	Beaver	6188	0.20	0.0			0.20	0.00
Lower West Fork Beaver Creek	Beaver	4044	1.31	1.3			1.31	0.00
Lumgrey Creek	Beaver	5496	0.44	1.0			0.44	0.00
McKinney Creek	Beaver	7275	0.80	0.0			0.80	0.00
Miller Gulch-Klamath River	Beaver	6557	0.30	12.6			0.31	0.02

7th Field Watershed	2014 Fire	Drainage Area (acres)	Current ERA Risk Ratio	ERAs Fire, Salvage, Site Prep	ERA temp roads	ERA legacy Sites	ERA Risk Ratio	Change in ERA from Action
Quigleys Cove-Klamath River	Beaver	6162	0.37	40.9	0.1		0.42	0.06
Soda Creek-Beaver Creek	Beaver	7370	1.08	2.3			1.08	0.00
Vesa Creek	Beaver	3141	0.10	0.0			0.10	0.00
Bear Creek	Happy Camp Complex	6698	0.66	1.3			0.66	0.00
Benjamin Creek-Klamath River	Happy Camp Complex	9998	0.41	7.8			0.42	0.01
Big Ferry-Swanson	Happy Camp Complex	7612	1.14	15.9	0.0		1.16	0.02
Bishop Creek-Elk Creek	Happy Camp Complex	9253	0.57	6.0		-4.1	0.58	0.00
Caroline Creek-Klamath River	Happy Camp Complex	1801	0.54	9.6	0.6		0.60	0.06
China Creek	Happy Camp Complex	6189	0.86	37.9	1.3		0.94	0.08
Cliff Valley Creek	Happy Camp Complex	3952	0.35	16.4	1.2		0.41	0.06
Cougar Creek-Elk Creek	Happy Camp Complex	6918	0.39	10.2	0.1	-19.2	0.37	-0.02
Deep Creek-Scott River	Happy Camp Complex	3798	0.44	3.7			0.45	0.01
Doolittle Creek	Happy Camp Complex	4050	0.56	10.1		-8.5	0.57	0.01
Franklin Gulch-Scott River	Happy Camp Complex	6450	0.37	6.4			0.38	0.01
Granite Creek	Happy Camp Complex	7541	0.59	0.0			0.59	0.00
Headwaters Elk Creek	Happy Camp Complex	2688	0.32	0.0			0.32	0.00
Hoop&Devil-Elk Creek	Happy Camp Complex	3075	0.39	54.0		-8.7	0.53	0.15
Horse Creek	Happy Camp Complex	2537	0.74	21.8	0.0		0.83	0.09
Lower East Fork Elk Creek	Happy Camp Complex	3430	0.43	7.9	0.3	-15.7	0.41	-0.02
Lower Grider Creek	Happy Camp Complex	10768	0.71	47.5	0.6		0.77	0.06
Lower Seiad Creek	Happy Camp Complex	3844	0.31	0.0			0.31	0.00
McCarthy Creek-Scott River	Happy Camp Complex	11611	0.51	18.9	0.2		0.52	0.02
Middle Creek	Happy Camp Complex	4496	0.69	41.0	0.6		0.80	0.11
Middle Elk Creek	Happy Camp Complex	2727	1.40	0.0			1.40	0.00
Negro Creek	Happy Camp Complex	2111	0.48	0.0			0.48	0.00
North Fork Kelsey Creek	Happy Camp Complex	5177	0.28	0.3			0.28	0.00
O'Neil Creek	Happy Camp Complex	2429	0.82	15.5	0.8		0.91	0.08

7th Field Watershed	2014 Fire	Drainage Area (acres)	Current ERA Risk Ratio	ERAs Fire, Salvage, Site Prep	ERA temp roads	ERA legacy Sites	ERA Risk Ratio	Change in ERA from Action
Rainy Valley Creek	Happy Camp Complex	2985	0.11	0.0			0.11	0.00
Rancheria Creek	Happy Camp Complex	4374	0.88	8.4			0.90	0.03
Sambo Gulch-Klamath River	Happy Camp Complex	6393	0.29	0.1			0.29	0.00
Schutts Gulch-Klamath River	Happy Camp Complex	6692	0.59	6.0	0.3		0.60	0.01
South Fork Kelsey Creek	Happy Camp Complex	6199	0.21	0.7			0.21	0.00
Tom Martin Creek-Klamath River	Happy Camp Complex	10690	0.53	42.3	0.2		0.58	0.04
Tompkins Creek	Happy Camp Complex	9327	0.53	48.7	0.1		0.60	0.07
Toms Valley Creek-Elk Creek	Happy Camp Complex	4564	0.23	0.0			0.23	0.00
Upper Canyon Creek	Happy Camp Complex	5179	0.08	0.0			0.08	0.00
Upper East Fork Elk Creek	Happy Camp Complex	3873	0.58	12.9	0.2	-13.7	0.58	0.00
Upper Elk Creek	Happy Camp Complex	3025	0.54	24.1	1.4	-5.0	0.63	0.09
Upper Grider Creek	Happy Camp Complex	8467	0.42	28.9	2.7		0.47	0.05
Walker Creek	Happy Camp Complex	7635	1.06	27.1	2.5		1.12	0.06
West Grider Creek-Klamath River	Happy Camp Complex	4026	0.41	6.1			0.42	0.02
Big Creek	Whites	2735	0.00	0.4			0.00	0.00
Eddy Gulch	Whites	4425	0.49	4.5			0.50	0.01
Jackass Gulch	Whites	2807	0.26	0.0			0.26	0.00
Jessups Gulch-North Fork Salmon River	Whites	4546	0.45	0.0			0.45	0.00
Lower North Russian Creek	Whites	4501	0.76	79.3			0.98	0.22
Lower South Russian Creek	Whites	2138	0.88	2.9			0.90	0.02
Music Creek	Whites	3286	1.03	4.7	0.0		1.05	0.02
Robinson Gulch-North Fork Salmon River	Whites	5202	0.74	10.1			0.76	0.02
Shadow Creek	Whites	5690	0.55	25.1	0.1		0.60	0.04
Sixmile Creek	Whites	4049	0.18	3.9			0.19	0.01
Specimen Creek	Whites	5009	0.30	0.0			0.30	0.00
Sugar Creek	Whites	8760	0.21	0.0			0.21	0.00
Taylor Creek	Whites	4016	0.54	3.2			0.55	0.01
Upper French Creek	Whites	8721	0.58	0.0			0.58	0.00
Upper North Russian Creek	Whites	3130	0.39	72.9			0.70	0.31
Upper South Russian Creek	Whites	6396	0.38	2.7	0.2		0.39	0.01
Whites Gulch	Whites	8576	0.64	223.8	0.3		0.97	0.33
Yellow Dog Creek-North Fork Salmon River	Whites	9239	0.20	72.2			0.28	0.08

Table H-41. USLE model outputs reflecting current condition and effects of Consultation Action by 7th field watershed.

7th Field Watershed	2014 Fire	Current Risk Ratio	USLE Fire, Salvage, Site Prep (yd3/year)	USLE temp roads (yd3/year)	USLE legacy Sites (yd3/year)	USLE Risk Ratio	Changes in USLE from Action
Bear Creek	Beaver	0.85	0.0			0.85	0.00
Buckhorn Creek	Beaver	0.85	2.8			0.85	0.00
Buckhorn Gulch-Beaver Creek	Beaver	1.34	2.1			1.35	0.01
Collins Creek-Klamath River	Beaver	0.89	1.0			0.89	0.00
Doggett Creek	Beaver	1.52	1.9			1.53	0.00
Dona Creek-Klamath River	Beaver	1.13	1.8			1.14	0.01
Dutch Creek	Beaver	1.67	4.4			1.70	0.03
Jaynes Canyon	Beaver	1.68	0.0			1.68	0.00
Kohl Creek	Beaver	1.53	4.7	0.1		1.55	0.01
Little Humbug Creek	Beaver	0.25	0.0			0.25	0.00
Lower West Fork Beaver Creek	Beaver	1.65	0.0			1.65	0.00
Lumgrey Creek	Beaver	1.38	0.0			1.38	0.00
McKinney Creek	Beaver	1.00	0.0			1.00	0.00
Miller Gulch-Klamath River	Beaver	0.48	0.0			0.48	0.00
Quigleys Cove-Klamath River	Beaver	0.73	0.8	0.03		0.74	0.01
Sambo Gulch-Klamath River	Beaver	0.39	0.0			0.39	0.00
Soda Creek-Beaver Creek	Beaver	1.60	0.0			1.60	0.00
Vesa Creek	Beaver	0.25	0.0			0.25	0.00
Bear Creek	Happy Camp Complex	0.28	0.0			0.28	0.00
Benjamin Creek-Klamath River	Happy Camp Complex	0.33	0.0			0.33	0.00
Big Ferry-Swanson	Happy Camp Complex	0.73	2.1	0.01		0.73	0.01
Bishop Creek-Elk Creek	Happy Camp Complex	0.10	0.0		-2.8	0.09	0.00
Caroline Creek-Klamath River	Happy Camp Complex	0.60	6.0	2		0.64	0.04
China Creek	Happy Camp Complex	0.79	5.6	2.9		0.81	0.02
Cliff Valley Creek	Happy Camp Complex	0.63	5.8	3.5		0.65	0.02
Cougar Creek-Elk Creek	Happy Camp Complex	0.50	0.4	0.1	-24.1	0.45	-0.05
Deep Creek-Scott River	Happy Camp Complex	0.52	0.7			0.53	0.00
Doolittle Creek	Happy Camp Complex	0.42	1.0		-8.3	0.41	-0.02
Franklin Gulch-Scott River	Happy Camp Complex	0.39	0.0			0.39	0.00

7th Field Watershed	2014 Fire	Current Risk Ratio	USLE Fire, Salvage, Site Prep (yd3/year)	USLE temp roads (yd3/year)	USLE legacy Sites (yd3/year)	USLE Risk Ratio	Changes in USLE from Action
Fryingpan Creek-Klamath River	Happy Camp Complex	1.07	2.5	0.2		1.08	0.01
Granite Creek	Happy Camp Complex	0.00	0.0			0.00	0.00
Headwaters Elk Creek	Happy Camp Complex	0.42	0.0			0.42	0.00
Hoop&Devil-Elk Creek	Happy Camp Complex	0.63	0.4		-12.1	0.57	-0.06
Horse Creek	Happy Camp Complex	1.00	6.3	0.01		1.03	0.03
Lower East Fork Elk Creek	Happy Camp Complex	1.00	1.2	0.4	-25.7	0.91	-0.09
Lower Grider Creek	Happy Camp Complex	0.77	26.9	0.7		0.79	0.02
Lower Seiad Creek	Happy Camp Complex	0.16	0.0			0.16	0.00
McCarthy Creek-Scott River	Happy Camp Complex	0.49	4.8	0.2		0.50	0.01
Middle Creek	Happy Camp Complex	0.87	8.7	1		0.89	0.02
Middle Elk Creek	Happy Camp Complex	0.12	0.0			0.12	0.00
Negro Creek	Happy Camp Complex	0.91	0.0			0.91	0.00
North Fork Kelsey Creek	Happy Camp Complex	0.50	0.0			0.50	0.00
O'Neil Creek	Happy Camp Complex	1.58	4.8	2.2		1.60	0.02
Rainy Valley Creek	Happy Camp Complex	0.17	0.0			0.17	0.00
Rancheria Creek	Happy Camp Complex	1.14	0.0			1.14	0.00
Schutts Gulch-Klamath River	Happy Camp Complex	0.74	0.5	1		0.75	0.00
South Fork Kelsey Creek	Happy Camp Complex	0.18	0.0			0.18	0.00
Tom Martin Creek-Klamath River	Happy Camp Complex	0.78	9.6	0.4		0.79	0.01
Tompkins Creek	Happy Camp Complex	0.82	11.2	0.1		0.83	0.01
Toms Valley Creek-Elk Creek	Happy Camp Complex	0.32	0.0			0.32	0.00
Upper Canyon Creek	Happy Camp Complex	0.01	0.0			0.01	0.00
Upper East Fork Elk Creek	Happy Camp Complex	0.81	1.4	0.2	-34.1	0.74	-0.08
Upper Elk Creek	Happy Camp Complex	0.93	19.2	3.1	-9.8	0.96	0.03

7th Field Watershed	2014 Fire	Current Risk Ratio	USLE Fire, Salvage, Site Prep (yd3/year)	USLE temp roads (yd3/year)	USLE legacy Sites (yd3/year)	USLE Risk Ratio	Changes in USLE from Action
Upper Grider Creek	Happy Camp Complex	0.55	12.6	5.5		0.57	0.02
Walker Creek	Happy Camp Complex	0.98	15.0	9.4		1.00	0.02
West Grider Creek-Klamath River	Happy Camp Complex	0.88	0.0			0.88	0.00
Big Creek	Whites	0.00	0.6			0.00	0.00
Eddy Gulch	Whites	0.97	0.1			0.97	0.00
Jackass Gulch	Whites	0.27	0.0			0.27	0.00
Jessups Gulch-North Fork Salmon River	Whites	0.40	0.0			0.40	0.00
Lower North Russian Creek	Whites	0.79	4.7			0.81	0.01
Lower South Russian Creek	Whites	0.81	0.0			0.81	0.00
Music Creek	Whites	0.82	1.2	0.1		0.83	0.00
Robinson Gulch-North Fork Salmon River	Whites	0.85	1.0			0.85	0.00
Shadow Creek	Whites	0.96	7.3	0.2		0.98	0.01
Sixmile Creek	Whites	0.56	0.0			0.56	0.00
Specimen Creek	Whites	0.09	0.0			0.09	0.00
Sugar Creek	Whites	0.25	0.0			0.25	0.00
Taylor Creek	Whites	0.55	0.2			0.55	0.00
Upper French Creek	Whites	0.33	0.0			0.33	0.00
Upper North Russian Creek	Whites	0.40	29.9			0.47	0.07
Upper South Russian Creek	Whites	0.46	3.2	0.9		0.47	0.00
Whites Gulch	Whites	0.83	41.1	1.1		0.86	0.03
Yellow Dog Creek-North Fork Salmon River	Whites	0.30	2.7			0.31	0.00

Table H-42. GEO model outputs reflecting current condition and effects of Consultation Action by 7th field watershed.

7th Field Watershed	2014 Fire	Current Risk Ratio	GEO Fire, Salvage, Site Prep (yd3/decade)	GEO temp roads (yd3/decade)	GEO legacy Sites (yd3/decade)	Risk Ratio	Changes to Risk Ratio from Action
Bear Creek	Beaver	0.73	0			0.73	0.00
Buckhorn Creek	Beaver	0.68	531			0.69	0.01
Buckhorn Gulch-Beaver Creek	Beaver	1.18	1193			1.21	0.03
Collins Creek-Klamath River	Beaver	0.78	163			0.79	0.01

7th Field Watershed	2014 Fire	Current Risk Ratio	GEO Fire, Salvage, Site Prep (yd3/decade)	GEO temp roads (yd3/decade)	GEO legacy Sites (yd3/decade)	Risk Ratio	Changes to Risk Ratio from Action
Doggett Creek	Beaver	1.11	572			1.13	0.01
Dona Creek-Klamath River	Beaver	1.17	395			1.19	0.02
Dutch Creek	Beaver	0.93	1408	53		0.99	0.06
Jaynes Canyon	Beaver	0.85	0			0.85	0.00
Kohl Creek	Beaver	1.19	698	13		1.22	0.04
Little Humbug Creek	Beaver	0.65	0			0.65	0.00
Lower West Fork Beaver Creek	Beaver	1.05	0			1.05	0.00
Lumgrey Creek	Beaver	1.04	0			1.04	0.00
McKinney Creek	Beaver	1.97	0			1.97	0.00
Miller Gulch-Klamath River	Beaver	0.75	0			0.75	0.00
Quigleys Cove-Klamath River	Beaver	0.72	986	12		0.77	0.05
Soda Creek-Beaver Creek	Beaver	1.46	0			1.46	0.00
Vesa Creek	Beaver	0.67	0			0.67	0.00
Bear Creek	Happy Camp Complex	1.01	0			1.01	0.00
Benjamin Creek-Klamath River	Happy Camp Complex	0.63	0			0.63	0.00
Big Ferry-Swanson	Happy Camp Complex	0.62	35	0		0.62	0.00
Bishop Creek-Elk Creek	Happy Camp Complex	1.76	0		-149	1.76	0.00
Caroline Creek-Klamath River	Happy Camp Complex	1.64	156	61		1.66	0.02
China Creek	Happy Camp Complex	0.76	590	134		0.78	0.02
Cliff Valley Creek	Happy Camp Complex	0.32	365	57		0.35	0.03
Cougar Creek-Elk Creek	Happy Camp Complex	0.64	16	1	-1080	0.60	-0.04
Deep Creek-Scott River	Happy Camp Complex	1.39	36			1.39	0.00
Doolittle Creek	Happy Camp Complex	0.46	17		-309	0.44	-0.02
Franklin Gulch-Scott River	Happy Camp Complex	0.39	0			0.39	0.00
Fryingpan Creek-Klamath River	Happy Camp Complex	0.76	87	5		0.76	0.00
Granite Creek	Happy Camp Complex	1.52	0			1.52	0.00
Headwaters Elk Creek	Happy Camp Complex	0.15	0			0.15	0.00
Hoop&Devil-Elk Creek	Happy Camp Complex	0.60	9		-311	0.57	-0.03
Horse Creek	Happy Camp Complex	0.81	919	0		0.91	0.10

7th Field Watershed	2014 Fire	Current Risk Ratio	GEO Fire, Salvage, Site Prep (yd3/decade)	GEO temp roads (yd3/decade)	GEO legacy Sites (yd3/decade)	Risk Ratio	Changes to Risk Ratio from Action
Lower East Fork Elk Creek	Happy Camp Complex	0.49	42	11	-680	0.42	-0.07
Lower Grider Creek	Happy Camp Complex	1.09	1921	70		1.12	0.04
Lower Seiad Creek	Happy Camp Complex	0.16	0			0.16	0.00
McCarthy Creek-Scott River	Happy Camp Complex	0.43	275	4		0.43	0.01
Middle Creek	Happy Camp Complex	1.09	1919	75		1.19	0.11
Middle Elk Creek	Happy Camp Complex	2.85	0			2.85	0.00
Negro Creek	Happy Camp Complex	0.24	0			0.24	0.00
North Fork Kelsey Creek	Happy Camp Complex	0.46	0			0.46	0.00
O'Neil Creek	Happy Camp Complex	1.53	90	14		1.54	0.01
Rainy Valley Creek	Happy Camp Complex	0.02	0			0.02	0.00
Rancheria Creek	Happy Camp Complex	0.68	0			0.68	0.00
Sambo Gulch-Klamath River	Happy Camp Complex	0.69	0			0.69	0.00
Schutts Gulch-Klamath River	Happy Camp Complex	1.16	8	11		1.16	0.00
South Fork Kelsey Creek	Happy Camp Complex	0.35	0			0.35	0.00
Tom Martin Creek-Klamath River	Happy Camp Complex	0.44	645	20		0.46	0.02
Tompkins Creek	Happy Camp Complex	0.82	1272	8		0.85	0.03
Toms Valley Creek-Elk Creek	Happy Camp Complex	0.60	0			0.60	0.00
Upper Canyon Creek	Happy Camp Complex	0.07	0			0.07	0.00
Upper East Fork Elk Creek	Happy Camp Complex	0.54	98	5	-591	0.50	-0.04
Upper Elk Creek	Happy Camp Complex	0.44	248	40	-238	0.45	0.01
Upper Grider Creek	Happy Camp Complex	0.32	1569	224		0.37	0.05
Walker Creek	Happy Camp Complex	1.92	817	715		1.96	0.04
West Grider Creek-Klamath River	Happy Camp Complex	0.59	0			0.59	0.00
Big Creek	Whites	0.00	0			0.00	0.00
Eddy Gulch	Whites	0.76	0			0.76	0.00

7th Field Watershed	2014 Fire	Current Risk Ratio	GEO Fire, Salvage, Site Prep (yd3/decade)	GEO temp roads (yd3/decade)	GEO legacy Sites (yd3/decade)	Risk Ratio	Changes to Risk Ratio from Action
Jackass Gulch	Whites	0.19	0			0.19	0.00
Jessups Gulch-North Fork Salmon River	Whites	0.59	0			0.59	0.00
Lower North Russian Creek	Whites	0.84	162			0.85	0.01
Lower South Russian Creek	Whites	0.63	0			0.63	0.00
Music Creek	Whites	1.17	33	1		1.17	0.00
Robinson Gulch-North Fork Salmon River	Whites	0.79	37			0.80	0.00
Shadow Creek	Whites	0.45	62	1		0.45	0.00
Sixmile Creek	Whites	0.38	0			0.38	0.00
Specimen Creek	Whites	0.65	0			0.65	0.00
Sugar Creek	Whites	0.45	0			0.45	0.00
Taylor Creek	Whites	0.54	0			0.54	0.00
Upper French Creek	Whites	0.78	0			0.78	0.00
Upper North Russian Creek	Whites	0.98	0			0.98	0.00
Upper South Russian Creek	Whites	0.77	16	5		0.77	0.00
Whites Gulch	Whites	0.61	218	6		0.62	0.01
Yellow Dog Creek-North Fork Salmon River	Whites	0.28	0			0.28	0.00

Appendix C: Klamath National Forest Matrix: Table of Population and Habitat Indicators for Use on the Klamath National Forest in the Northwest Forest Plan Area

Aquatic Habitat Conditions Analysis Guidelines

AP = Analytical Process for Developing Biological Assessments for Federal Actions Affecting Fish within the Northwest Forest Plan Area (USDI, USDA, and NOAA 2004).

Available at www.blm.gov/or/esa/reports/**Analytical_Process_**110504.doc.

The table(s) within this Appendix show criteria used to determine baseline conditions in 7th-and **5th-field** watersheds within the KNF boundaries that contain anadromous fish habitat. The criteria in the Table and footnotes are used to describe the current condition of Klamath Mountains watersheds, and to determine if projects are likely to affect anadromous salmonids via effects on salmonid habitat components. Current conditions of watershed(s) are assessed and documented in the Table of Habitat Indicators; and effects to Indicators from proposed actions are discussed in the narrative within the BA/BE and summarized in the Table of Habitat Indicators.

The initial KNF-NMFS Level 1 review of the Table criteria was completed by Perrochet, Thomas, and Flickinger in April 2007. Edits to LWD were made in March 2009 to reflect LRMP EIS values. The Table was updated in 2004 as part of the Analytical Process for ESA consultation with NMFS. In May 2012 Grunbaum and Meneks provided updates/edits to this document and the Table of Habitat Indicators.

The Table, as designed in the 2004 Analytical Process, and in earlier versions (1997 NMFS BO for the LRMP), suggests values to determine a level of functioning for anadromous fish bearing streams. A note about rigid values to assess level of functioning: in addition to fixed habitat parameters not allowing for natural variability, fixed habitat parameters set standards that may be geomorphically inappropriate (Bisson et al. 1997). Variability is an inherent property of aquatic ecosystems in the Pacific Northwest and habitats at any given location will change from year to year, decade to decade, and century to century (Bisson et al. 1997). Healthy lotic ecosystems require different parts of the channel system to exhibit very different in-channel conditions and that those conditions change through time (Reid and Furniss 1998). Also, data may not be available for the stream being assessed. Therefore, a conclusion of function must be evaluated with professional judgment recognizing the streams capability to perform within rigid values. In some cases, a stream's morphology, aspect or size may not support "Properly Functioning" criteria values for one or more habitat Indicators. If an Indicator for a particular stream is determined to be functioning at its capability (due to morphology, aspect, or size), it is rated as Properly Functioning even if it doesn't meet Table criteria values. In the absence of available data, table and associated footnotes suggest factors that should be considered when evaluating indicators.

Klamath National Forest Tributaries Table of Pathways and Indicators

Klamath National Forest Tributaries Table of Pathways and Indicators:				
Pathways	***Indicators***	***Properly Functioning***	***At Risk***	***Not Properly Functioning***
Habitat: Non Watershed Condition Indicators				
Water Quality:	Temperature [(1)]			
	1st - 3rd Order Streams [instantaneous]	69 F degrees (~ 20.5 C) or less	> 69 to 70.5 degrees F	70.5 F degrees (~ 21.3 C) or more
	4th-5th Order Streams [Maximum Weekly Maximum Temperature]	70.5 F degrees (~ 21.4 C) or less	> 70.5 to 73.5 degrees F	73.5 F degrees (~ 23.0 C) or more
	Suspended Sediment/Turbidity	Little to no quantitative turbidity data exists for streams on the Klamath National Forest. Use the following criteria to infer condition of turbidity Indicator: (1) professional judgment from years of direct observation of tributary streams; (2) amount of fines in substrate from stream survey data, (3) CWE modeled level of watershed surface erosion and mass wasting, and (4) condition of stream buffer RR and channel (particularly if there has been recent debris flows that altered the channel). Professional judgment of turbidity is based on observations of water clarity after peak flows in tributaries to the mainstems of the Klamath, Scott, and Salmon Rivers that have watersheds with varying degrees of disturbance from nearly pristine to highly disturbed. Properly Functioning: Water clarity returns quickly (within three days) following peak flows.	Water clarity slow (four to six days) to return following peak flows, moderate to high fines in substrate, moderate modeled surface erosion and mass wasting, and RRs are not fully functioning.	Water clarity poor for long periods of time (one week or more) following peak flows. Some suspended sediments occur even at low flows or base flow. High fines in substrate, stream buffers in poor condition, high modeled surface erosion and mass wasting, and riparian reserves are in poor condition.

Klamath National Forest Tributaries Table of Pathways and Indicators:				
	Chemical/Nutrient Contamination (2)	Scott, Salmon, and Klamath River mainstems: Low levels of contamination from agriculture, industrial, and other sources; no excess nutrients. No CWA 303d designated reaches. Scott, Salmon, and Klamath River tributaries: None or low levels of chemical and/or nutrient contamination from agriculture, industrial, and other sources; no excess nutrients.	Scott, Salmon, and Klamath River mainstems: Moderate levels of contamination from agriculture, industrial, and other sources; some excess nutrients. One or more CWA 303d designated reaches Scott, Salmon, and Klamath River tributaries: Moderate levels of contamination from agriculture, industrial, and other sources and/or moderate excess nutrients.	Scott, Salmon, and Klamath Rivers: mainstems: High levels of contamination from agriculture, industrial, and other sources; high levels of nutrients. One or more CWA 303d designated reaches Scott, Salmon, and Klamath River tributaries: High levels of contamination from agriculture, industrial, and other sources and/or moderate to high excess nutrients.
Habitat Access:	Physical Barriers (AP)	Any man-made barriers present in watershed allow upstream and downstream passage at all flows.	One or more human - made barriers present in watershed do not allow upstream and/or downstream passage at base/low flows.	Human-made barriers present in watershed do not allow upstream and/or downstream passage at a range of flows for at least one life history stage.
	Substrate character (3)	Use stream survey data for determining substrate character. In addition, use USLE and GEO models to determine functioning level of Indicator and potential effects of sediment delivery to streams that may affect anadromous fish and their habitat. Can also infer substrate character functioning level from other factors such as high road density and hydrologic connection, recent large intense wildfires, and recent (last 20 years) altered channel.		
Habitat Elements:		Less than 15% fines (<2 mm) in spawning habitat (pool tail-outs, low gradient riffles, and glides) and cobble embeddedness less than 20%. Additional desired conditions, as per TMDL/NCRWB water quality compliance, include: *Pool sediment vol (V*): ≤21% *Subsurface, <0.85 mm: ≤14% *Subsurface, <6.4 mm: ≤30%	15% or greater fines (<2 mm) in spawning habitat (pool tail-outs, low gradient riffles, and glides) and/or cobble embeddedness is 20% or greater.	Greater than 20% fines (<2 mm) in spawning habitat (pool tail-outs, low gradient riffles, and glides) and cobble embeddedness greater than 25%.
	Large Woody Debris (4)	See KNF LRMP EIS Chapter 3, text and tables on Pages 68-69. For stream reaches on the Westside of the Forest, manage for an average of 20 pieces of large wood per 1,000 ft in 3-5th order streams (LRMP Page 4-143). Large wood is defined as a minimum length of 50 feet and diameter of 24 inches on the Westside. However, site potential and channel width must be considered rather than using strict numbers. Also consider the potential for future LWD recruitment in both the short- and long-term.	Current levels are being maintained at minimum levels desired for "properly functioning" but potential sources for long term woody debris recruitment are lacking to maintain these minimum values.	Current levels are not at those desired levels for "properly functioning" and potential sources of woody debris for short and/or long term recruitment are lacking.

Klamath National Forest Tributaries Table of Pathways and Indicators:				
	Pool Quality and Frequency (5)	At least one primary pool every three to seven bankfull channel widths. In 1st through 3rd order streams, a primary pool must have a maximum depth of two feet or greater. In 4th and 5th order streams, a primary pool must have a maximum depth of three feet or greater. In 6th order and larger streams, a primary pool must have a maximum depth of four feet or greater.	At least one pool every three to seven bankfull channel widths. At least half of the pools are primary pools. At least half the pools have a maximum depth of at least 24 inches (1st- 3rd order streams) or 36 inches (4th order and greater).	There is less than one pool every three to seven bankfull channel widths and/or less than half the pools have maximum depth of at least 24 inches (1st-3rd order streams) or 36 inches (4th order and greater).
	Off-Channel Habitat	Fish have unrestricted access to off-channel habitats (such as oxbows, off-channel ponds, backwaters, and areas of low flow velocity and cover) in unconstrained reaches during high flows and flooding events in winter. And these off-channel areas are relatively undisturbed by dikes, levees, dredge tailings, roads, excavations, fills, flow diversions, development, vegetation clearing, wood removal, poor water quality, etc.	Fish access to off-channel habitats, and the quantity and quality of off-channel habitats, in unconstrained reaches, is diminished due to dikes, levees, dredge tailings, roads, excavations, fills, flow diversions, development, vegetation clearing, wood removal, poor water quality, etc.	Fish access to off-channel habitats in unconstrained reaches is severely restricted or impossible due to dikes, levees, dredge tailings, roads, excavations, fills, flow diversions, development, etc., and/or the quality of the off-channel habitats is poor due to vegetation clearing, wood removal, poor water quality, and the other factors listed above. .
Habitat Elements:	Refugia (important remnant habitat for sensitive aquatic species)	CHs necessary for successful completion of all anadromous salmonid life history phases (spawning, incubation, emergence, freshwater rearing, and migration) are functioning, accessible, and well-distributed. Critical summer refugia in Klamath Mountain streams include: (1) thermal refugia and (2) anadromous stream reaches with intact RRs, cool clean water, pools that are not filled-in or partially filled-in with excess sediment, adequate stream flows, and good water quality. Critical winter habitat for anadromous salmonids includes side channels, off-channel habitats, and floodplain habitats.	Not all CHs necessary for successful completion of all anadromous salmonid life history phases are functioning and/or accessible for salmonids and/or well-distributed. Habitat quality and/or accessibility is diminished due to dikes, levees, dredge tailings, other fills, roads, excavations, flow diversions, development, vegetation clearing, wood removal, poor water quality, etc.	Many of the CHs necessary for successful completion of all anadromous salmonid life history phases are not functioning and/or not accessible for salmonids, and are thus are poorly distributed across the stream network and not providing adequate biological connectivity.

Klamath National Forest Tributaries Table of Pathways and Indicators:				
Channel Condition and Dynamics:	Width/Depth Ratio (6)	Width-to-Depth ratio < 12 on all reaches that could otherwise best be described as 'A', 'G', and 'E' channel types. Width-to-Depth ratio > 12 on all reaches that could otherwise best be described as 'B', 'F', and 'C' channel types. No braided streams formed due to excessive sediment loads. Lacking data, width-to-depth ratio should be evaluated considering the following factors: (1) recent (last 20 years) history of debris flows that have scoured channel and resulted in aggradation or degradation of the stream bed, (2) recent history of mass wasting that delivered large volumes of sediment to the stream that may have filled in pools, (3) pool frequency and depth information from stream surveys, (4) watershed disturbance as estimated with CWE modeling for mass wasting (GEO) and peak flows (ERA/TOC), and (5) frequency of large woody debris in the stream channel. For properly functioning, stream crossing density is low, there have been few mass wasting events caused by management actions, there are numerous deep pools, modeled mass wasting and surface erosion is low, and there is adequate LWD. If there is no or little management disturbance legacy in a watershed, then width-to-depth ratio is assumed to be properly functioning.	More than 10% of the reaches are outside of the ranges given for Width/Depth ratios for the channel types specified in "Properly Functioning" block. Braiding has occurred in some alluvial reaches as a result of excessive aggradation due to high sediment loads. For at-risk, stream crossing density is moderate to high, there have been some mass wasting events caused by management actions, pool frequency and quality is at-risk, modeled mass wasting and surface erosion is moderate to high, and there is inadequate LWD.	More than 25% of the reaches are outside of the ranges given for Width/Depth ratios for the channel types specified in "Properly Functioning" block. Braiding has occurred in many alluvial reaches as a result of excessive aggradation due to high sediment loads. For not properly functioning, stream crossing density is high, there have been some large mass wasting events caused by management actions, pool frequency and quality is poor, modeled mass wasting and surface erosion is moderate to high, and there is inadequate LWD.

Klamath National Forest Tributaries Table of Pathways and Indicators:				
	Streambank Condition (AP)	> 80% of any stream reach has ≥ 90% stability. Most watersheds have no bank stability surveys data so the level of streambank stability should be evaluated by considering: (1) density of road-stream crossings per stream or stream reach, (2) amount of inner gorge road, (3) other clearing and/or compaction directly adjacent to the stream, (4) artificial banks created by pushing up berms, and (5) recent (since 1996) channel altering debris flows. For properly functioning: Stream crossing density is low to moderate, there is little to no inner gorge road, there is no or only minor disturbance next to the stream channel, there are few or no berms, dikes, or levees constraining the channel, and/or there has been no or minor channel alteration/filling due to debris flows/landslides related to past management actions.	50-80% of any stream reach has ≥ 90% stability. For at-risk: Stream crossing density is moderate to high, there is some inner gorge road, there is some disturbance next to the stream channel, there are some berms, dikes, or levees constraining the channel, and/or there has been some channel alteration/filling due to debris flows/landslides related to past management actions.	< 50% of any stream reach has ≥90% stability For not properly functioning: Stream crossing density is high, there is over a mile of inner gorge road, there is significant disturbance next to the stream channel, berms, dikes, or levees constrain over a mile of channel; and/or there has been significant channel alteration/filling due to debris flows/landslides related to past management actions.
	Floodplain Connectivity (AP)	Off-channel areas are frequently hydrologically linked to main channel; overbank flows occur and maintain wetland functions, riparian vegetation, and succession.	Reduced linkage of wetland, floodplains, and riparian areas to main channel; overbank flows are reduced relative to historic frequency, as evidenced by moderate degradation of wetland function, riparian vegetation/succession.	Severe reduction in hydrologic connectivity between off-channel, wetland, floodplain, and riparian areas; wetland area drastically reduced and riparian vegetation/succession altered significantly.
Flow / Hydrology:	Change in Peak/Base Flows (7)	Properly functioning watersheds for peak flow have low modeled ERA/TOC, low road density, few large clearings in the rain-snow transition zone, and vegetation close to reference condition. Properly functioning watersheds for base flow have low modeled ERA/TOC, low road density and hydrologic connectivity, and vegetation close to reference condition.	Watersheds at-risk for change in peak flow have moderately high to high modeled ERA/TOC, moderate to high road density, and/or some large recent clearings in the rain-snow transition zone. Watersheds at-risk for change in base flow have denser vegetation compared to reference conditions, several water diversions, and moderate density of roads that have hydrologic connectivity.	Watersheds not properly functioning or change in peak flow have high modeled ERA/TOC, high road density, and may have large recent clearings in the rain-snow transition zone. Watersheds not properly functioning for change in base flow have much denser vegetation compared to reference conditions, numerous or large water diversions, and high density of roads that have hydrologic connectivity.

Klamath National Forest Tributaries Table of Pathways and Indicators:				
	Increase in Drainage Network (AP)	Zero or minimum increases in active channel length correlated with human caused disturbance (e.g., trails, ditches, compaction, impervious surface, etc.). The primary cause of drainage network increase in Klamath Mountain watersheds is hydrologic connectivity between the road system and the stream network.	Low to Moderate increases in active channel length correlated with human caused disturbance (e.g., trails ditches, compaction, impervious surface, etc.).	Greater than moderate increase in active channel length correlated with human caused disturbance (e.g., trails ditches, compaction, impervious surface, etc.).
Watershed Condition Indicators				
Watershed Conditions:	Road Density and Location (AP)	Less than 2 miles per square mile.	Two to three miles per square mile.	Over 3 miles per square mile.
	RRs – NW Forest Plan (AP) [8]	The RR system provides adequate shade, large woody debris recruitment, and habitat protection and connectivity in all subwatersheds, and buffers or includes known refugia for sensitive aquatic species (> 80% intact), and/or for grazing impacts; percent similarity of riparian vegetation to the potential natural community/composition > 50%.	Moderate loss of connectivity or function (shade, LWD recruitment, etc.) of RR system, or incomplete protection of habitat and refugia for sensitive aquatic species (approx. 70-80% intact), and/or for grazing impacts; percent similarity of riparian vegetation to the potential natural community/composition 25-50% or better. Some past stand-replacement timber harvest or intense fire in RR, moderate road and landing density in RR, minor to moderate level of mining in RR, vegetation/fuels moderately departed from historic fuels conditions, species diversity and vegetation structure in stream buffers moderately altered from reference condition due to fire suppression and past timber harvest, and moderate modeled CWE values.	RR system is fragmented, poorly connected, or provides inadequate protection of habitat and refugia for sensitive aquatic species (approx. less than 70% intact), and/or for grazing impacts; percent similarity of riparian vegetation to the potential natural community/composition is 25% or less. Extensive past stand-replacement timber harvest or intense fire in RR, high road and landing density in RR, moderate to high intensity of mining in RR, vegetation/fuels greatly departed from historic fuels conditions, species diversity and vegetation structure in stream buffers significantly altered from reference condition due to fire suppression and past timber harvest, and high modeled CWE values.

Klamath National Forest Tributaries Table of Pathways and Indicators:				
	Disturbance History/Regime	Frequency, duration, and magnitude of stochastic disturbance events are close to reference condition. The following factors should be considered in rating the Watershed Disturbance/Regime indicators: (1) overall watershed disturbance as determined through CWE modeling, (2) road density and location, (3) current impacts from past stand-replacing forestry, mining, and intense fires, (4) departure from historic fire regime, (5) departure from historic vegetation structure and composition, and (6) character of development on private property. For properly functioning, a watershed should have low CWE and road density (all models under "1" threshold), few impacts from past stand-replacement forestry or intense fire, are not significantly departed from historic vegetation/fuels condition and fire regime, and/or have low disturbance on private property.	In at-risk watersheds, frequency, duration, and magnitude of stochastic disturbance events are moderately departed from reference condition. At-risk watersheds have moderate to high CWE and road density (one or two models over "1" threshold), some significant impacts from past stand-replacement forestry or intense fire, are moderately departed from historic vegetation/fuels condition and fire regime, and/or have moderate disturbance on private property.	In not properly functioning watersheds, frequency, duration, and magnitude of stochastic disturbance event is significantly departed from reference condition. Not properly functioning watersheds have high CWE and road density (all models over "1" threshold), significant impacts from past stand-replacement forestry or intense fire, are significantly departed from historic vegetation/fuels condition and fire regime, and/or have significant disturbance on private properties.
Summary Integration of all species and habitat indicators effects	How do the effects to indicators affect each fish species and their habitat? Describe by species and by 7th and **5th-field** watersheds. See AP guidance. In addition to the narrative summary, use Summary Table in Tables required for BA/BE.			

Footnotes to Table Above: Table of Population and Habitat Indicators For Use on the Klamath National Forest in the Northwest Forest Plan Area, as adjusted from Appendix A in the Analytical Process.

1) (Temperature) Proper Functioning criteria for 4th -5th Order streams is derived from temperature monitoring near the mouth of streams of relatively undisturbed watersheds (Clear, Dillon, and Wooley Creeks). –Maximum Weekly Maximum Temperatures (MWMT) as high as 70.5 degrees F have been recorded on these streams (EA Engineering, 1998 Salmon River and Dillon Creek Watershed Fish Habitat and Channel Type Analysis, Appendix 2). At-Risk criteria

for 4th/5th order streams is derived from monitoring in streams that support populations of anadromous fish, although temperatures in this range (70.5 to 73.5 degrees F) are considered sub-optimal. The Not Properly Functioning criterion is sustained temperatures above 73.5 degrees F - that causes cessation of growth and approach lethal temperatures for salmon and steelhead. Properly Functioning criteria for 1st - 3rd order streams is derived from Desired Future Conditions (DFC) values given in the LRMP EIS p 3-68. At Risk and Not Properly Functioning criteria for 1st – 3rd order streams are assigned on a temperature continuum with values given for 4th/5th order streams, with the maximum instantaneous temperature of At Risk 1st - 3rd order streams coinciding with the minimum MWMT of 4th/5th order At Risk streams. [Stream Order according to Strahler (1957).]

(2) (Chemical/Nutrient Contamination) For projects within the river corridors of the mainstem Scott, Salmon, and Klamath Rivers the criteria is unchanged from AP Table. For tributaries to the Scott, Salmon, and Klamath Rivers use the criteria from the AP table. Although these tributaries have CWA 303d designation, Klamath National Forest tributaries are typically properly functioning for dissolved oxygen, nutrients, and microcystin, and because temperature and sediment is assessed in the Temperature and Substrate Character Indicators. Chemical contamination and nutrients should be assessed for Scott, Salmon, and Klamath River tributaries.
(3) (Substrate Character) Use recent stream survey data where available. Properly Functioning criteria for % fines in gravel is from the LRMP EIS p 3-68. Additional Forest-wide desired conditions for sediment (pool sediment, subsurface sediment) are described by Laurie and Elder (2012) in relation to monitoring for TMDL and NCRWB water quality standards. When location-specific information is unavailable, use the following as best appropriate: use USLE and GEO models to determine functioning level of Indicator and potential effects of sediment delivery to streams that may affect anadromous fish and their habitat, infer substrate character functioning level from other factors such as high road density and degree of hydrologic connection, recent large intense wildfires, and recent (last 20 years) debris flows that altered channels, and lastly use professional judgment to describe existing conditions and to estimate effects based upon model output interpretation, research results, or other information. The KNF CWE modeling procedure describes the risk (probability) of project-caused sediment production (see 2004 CWE process paper, by Elder and Reichert, in fisheries sufficiency guides). For existing condition and effects of the action:

1. Properly Functioning: USLE and GEO values are less than 1.0
2. At Risk: USLE and GEO values are between 1.0-1.20
3. Not Properly Functioning: USLE and GEO values are greater than 1.20

(4) (Large Woody Debris) See KNF LRMP EIS Chapter 3, text and tables on Pages 68-69. For stream reaches on the Westside of the Forest, manage for an average of 20 pieces of large wood per 1,000 ft in 3-5th order streams (LRMP Page 4-143). Large wood is defined as a minimum length of 50 feet and diameter of 24 inches on the Westside. However, site potential and channel width must be considered rather than using strict numbers. Also consider the potential for future LWD recruitment in both the short- and long-term.
Criteria for length of LWD for larger streams may be based on average bankfull channel width of the reach: in streams larger than 3rd order a piece of woody debris may qualify as large woody debris in a stream reach if its length is 1.5 times the average bankfull channel width, or if it has a rootwad attached and its length is 1¼ times the average bankfull channel width. Stable pieces of woody debris remain stationary during normal to high flows. Channel width and depth largely determines whether large woody debris recruited into a stream reach will be stable, and largely determines the average size of wood retained in streams (Bilby and Ward 1989, 1991; Robison and Beschta 1990). As channels become wider and deeper, the average size of a stable piece of wood increases. Pieces shorter than bankfull width and with a diameter less than bankfull depth are more likely to be transported out of a reach by streamflow (Bilby 1984, Braudrick et al. 1997). Length of woody debris appears to be most important to its stability where stream

discharge is sufficient to float large diameter stems (Bilby 1985, Swanson and others 1984). Branches and/or rootwads, if still attached, add to the stability of woody debris. Therefore, criteria for length of LWD for larger streams may be based on average bankfull channel width of the reach: in streams larger than 3rd order a piece of woody debris may qualify as large woody debris in a stream reach if its length is 1.5 times the average bankfull channel width, or if it has a rootwad attached and its length is 1¼ times the average bankfull channel width.

(5) (Pool Quality and Frequency) A measurable pool is an area of channel which (1) shows clear signs that the pool was created by scour at high flows and/or that the pool is the result of the channel being dammed at the downstream end; (2) has a significant residual depth - the deepest part of the pool must be at least twice as deep as the water flowing out of the pool at the riffle crest; (3) has an essentially flat water surface during low flow - water surface slope <0.05 percent; and (4) includes most of the channel - it must include the thalweg and occupy at least half of the width of the low-flow channel. "Primary" pools are defined by their maximum depth in relationship to size or stream order. As the order or size of the stream increases the required minimum depth for a primary pool increases. In 1st through 3rd order streams, a primary pool must have a minimum depth of two feet or greater. In 4th and 5th order streams, a primary pool must have a minimum depth of three feet. In 6th order and larger streams, a primary pool must have a minimum depth of four feet.

(6) (Width/Depth Ratio) The Width-to-Depth ratio for various channel types is based on delineative criteria of Rosgen (1996). Properly Functioning means that Width-to-Depth ratio falls within expected channel type as determined by the other four delineative factors (entrenchment, sinuosity, slope, and substrate). Aggradation on alluvial flats causing braiding is well known phenomenon that often accompanies changes in Width-to-Depth ratio as watershed condition deteriorates. Stream width is a function of streamflow occurrence and magnitude, size and type of transported sediment, and the bed and bank materials of the channel (Rosgen 1996). Channel widths generally increase with flow volume downstream. Channel widths can be modified by changes in riparian vegetation, landslides particularly debris flows, changes in streamflow regimes, and changes in sediment supply. The AP Table indicates that confined or entrenched channel types (such as A, G, and E types) are Properly Functioning when Width-to-Depth ratios are <12, and wider channel types (such as B, C, and F types) are Properly Functioning when Width-to-Depth ratios are >12. To meet the Properly Functioning criteria channels must also have no or minimal braiding due to excessive sediment.

(7) (Peak/Base Flows) In most cases, sufficient hydrograph data is not available to determine comparative changes in peak flows as suggested in the AP. Infer changes in **peak flows** when no hydrograph data is available by considering the following factors: (1) CWE runoff model (ERA/TOC) outputs, (2) road density and the degree of hydrologic connectivity between the road system and the stream network, and (3) number, size, and vintage of openings in the forest canopy resulting from past stand-replacement forestry in the snow-rain transition zone where increased openings can result in elevated runoff from rain-on-snow events. The potential for decreased **base flows** in the Project HUC7 watersheds should be evaluated by considering the following factors: (1) increased/decreased evapotranspiration due to denser/sparser vegetation than reference condition that has resulted from stand-replacement forestry and/or fire suppression, (2) number and size of water diversions, and (3) degree of hydrologic connectivity between the road system and the stream network (watersheds with high road density likely have reduced base flows due to impervious surfaces and groundwater interception in road cuts).

(8) (RRs) The following factors should be considered in determining the condition of stream buffer (hydrologic) RR: (1) amount and age of past stand-replacement forestry or intense fire in

stream buffers, (2) road and landing density in stream buffers, (3) mining in stream buffers, (4) departure from historic fire regime, (5) condition of riparian vegetation for providing shade, large woody debris, sediment-filtering, and nutrient cycling, and (6) the amount of overall disturbance in the watershed particularly as estimated by the peak flow (ERA) and mass wasting (GEO) models. The following two factors should be considered in determining the condition of geologic RR: (1) amount and age of past stand-replacement timber harvest and/or recent intense wildfire on geologic RR and (2) road and landing density on geologic RR.

Appendix D: CHECKLIST FOR DOCUMENTING ENVIRONMENTAL BASELINE AND EFFECTS

OF PROPOSED ACTION(S) ON RELEVANT INDICATORS

PROJECT: **Westside Fire Recovery**

WATERSHED: **Beaver Creek**

Pathways: INDICATORS	ENVIRONMENTAL BASELINE **Beaver Creek 5th Field watershed**			EFFECTS OF THE ACTION(S) **Beaver Creek 5th Field watershed**		
	PROPERLY FUNCT	**AT RISK**	**NOT ROP FUNCT**	**RESTORE**	**MAINTAIN**	**DEGRADE**
Water Quality Temperature		**TEMP**			**X**	
Sediment-Turbidity			**SED KNF CWE PO/PJ**		**X**	
Chemical Contamination	**ND/PO/PJ**				**X**	
Habitat Access Physical Barrier	**FPI**				**X**	
Habitat Elements Substrate Character			**SED KNF CWE PO/PJ**		**X**	
Large Woody Debris			**SS89 KNF GIS PO/PJ**		**X**	
Pool Frequency/Quality			**KNF GIS SS06 PO/PJ**		**X**	
Off-channel Habitat		**PO/PJ**			**X**	
Refugia		**TEMP SS89 PO PJ**			**X**	
Channel Cond & Dyn Width-to-Depth Ratio			**SS89 Flood PO/PJ**		**X**	
Streambank Condition			**KNF GIS Flood PO PJ**		**X**	
Floodplain Condition		**PO/PJ**			**X**	
Flow /Hydrology Change in Peak/Base Flow			**KNF GIS RSS**		**X**	
Drainage Network Increase			**KNF GIS RSS**		**X**	
Watershed Cond. Road Density/Location			**KNF GIS RSS**		**X**	
Disturbance History/Regime			**KNF GIS Flood RSS**		**X**	

Pathways: INDICATORS	ENVIRONMENTAL BASELINE **Beaver Creek 5th Field watershed**			EFFECTS OF THE ACTION(S) **Beaver Creek 5th Field watershed**		
	PROPERLY FUNCT	**AT RISK**	**NOT ROP FUNCT**	**RESTORE**	**MAINTAIN**	**DEGRADE**
Riparian Reserves			**KNF GIS RSS PO/PJ**		**X**	

TEMP = Water temperature monitoring at RM 0.8 and RM 5.8 of mainstem Beaver Creek from 2010 to 2014, and water temperature monitoring of West Fork Beaver Creek at RM 0.8 from 2010 to 2014;
SS89 = 1989 KNF stream survey of mainstem Beaver Creek from mouth to Grouse Creek Confluence (9 miles);
SED = 2009, 2010, 2013 sediment assessment survey; **RSS =** KNF Road Sediment Source Inventory and Risk Assessment;
FPI = KNF Forest-Wide Fish Passage Barrier Inventory; **Flood** = KNF analysis of the 1997 New Year Flood; **ND** = No Data; **PJ** = Professional Judgement; **PO** = Personal Observation based on 20+ years observing; **NA** = Not Applicable;
KNF GIS = KNF GIS database query and CWE modeling for WFR Project (Fall 2014 to Winter 2015);
Environmental Baseline and Checklist last updated by Jon Grunbaum on April 3, 2015.

The Beaver Creek 5th-field (HUC10) watershed is an area of 69,610 acres. The Beaver Creek watershed is 64% National Forest land and the rest is mostly private industrial timberland. About 2% of the watershed is private residential. There is a 300-acre parcel of BLM land. The mainstem of Beaver Creek from the mouth to the confluence of West Fork Beaver Creek at RM 5.7 is a 5th-order (Strahler 1957) stream. This entire length of mainstem provides spawning and rearing habitat for Coho and Chinook salmon, and steelhead trout. The lower reaches of mainstem Beaver Creek provides thermal refugia for juvenile salmonids as does the creeks cold water plume at the confluence with the Klamath River. Based on recent annual spawning surveys: (1) Chinook salmon spawn in the lower two miles of mainstem Beaver Creek upstream of the West Fork confluence, and Coho salmon spawn in the lower half mile of mainstem Beaver Creek upstream of West Fork; (2) Chinook and Coho salmon spawn in the lower 2.5 miles of West Fork Beaver Creek; and (3) none of the other tributaries to mainstem Beaver Creek or mainstem WF Beaver Creek are known to support salmon. Steelhead utilize and mainstem habitats as well as these tributaries: Jaynes Canyon Creek, Bear Creek, Hungry Creek, Grouse Creek, and Cow Creek. The only current stream survey in the Beaver watershed was a physical and biological assessment of the lower few miles of Hungry Creek in 2010. Otherwise, the most recent surveys were 1989 stream surveys of mainstem Beaver Creek and West Fork Beaver Creek. Stream surveys prior to the 1997 Flood are not very reliable for portraying current condition because the 1997 Flood altered many of the stream channels and stream buffer, and altered substrate composition (but still useful for describing trend). Channel sediment metrics were assessed in 2009, 2010, and 2013 but those metrics are less reliable now for describing current condition because excess sediment has already been delivered to the channel as a result of the 2014 Beaver Fire (but still useful for describing trend).

Beaver Creek 5th-Field (HUC10) Watershed Environmental Baseline Elements:

WATER QUALITY

Water Temperature: From 2010 to 2014, summer water temperature of mainstem Beaver Creek was monitored just upstream from the mouth and at RM 5.8 (just above the West Fork Beaver Creek confluence); and summer water temperature of mainstem West Fork Beaver Creek was monitored just upstream from the mouth at about RM 0.8. The results of this monitoring is shown in the three tables below.

Recent Water Temperature Monitoring Results for Mainstem Beaver Creek Near Mouth						
Start	**End**	**Max Daily Max Temp C**	**Max Average Daily Temp C**	**Max Diurnal Variation Temp C**	**Maximum Weekly Average Temp C (MWAT)**	**Maximum Weekly Maximum Temp C (MWMT)**
10/8/2009	10/26/2010	19.5	17.1	5.2	16.9	18.9
6/10/2011	10/5/2011	18.0	15.9	4.3	15.7	17.7
6/15/2012	11/1/2012	20.3	18.0	4.7	17.4	19.6
6/11/2013	10/31/2013	21.7	19.1	5.1	18.5	20.7
6/3/2014	9/23/2014	23.2	20.3	6.3	19.6	22.4

Recent Water Temperature Monitoring Results for Mainstem Beaver Creek at RM 5.8						
Start	**End**	**Max Daily Max Temp C**	**Max Average Daily Temp C**	**Max Diurnal Variation Temp C**	**Maximum Weekly Average Temp C (MWAT)**	**Maximum Weekly Maximum Temp C (MWMT)**
6/27/2010	10/3/2010	17.9	16.4	4.8	16.1	17.5
6/22/2011	10/3/2011	16.6	15.1	5.5	14.9	16.1
6/15/2012	10/31/2012	18.2	17.0	4.5	16.4	17.7
6/11/2013	10/15/2013	19.1	17.8	4.1	17.2	18.4
6/3/2014	10/6/2014	20.3	18.8	4.1	18.3	19.8

Recent Water Temperature Monitoring Results for WF Beaver Creek at RM 0.8						
Start	**End**	**Max Daily Max Temp C**	**Max Average Daily Temp C**	**Max Diurnal Variation Temp C**	**Maximum Weekly Average Temp C (MWAT)**	**Maximum Weekly Maximum Temp C (MWMT)**
6/28/2010	10/2/2010	15.2	16.7	4.2	15.0	16.3
6/23/2011	10/2/2011	15.3	14.2	4.7	14.0	15.0
6/16/2012	10/31/2012	17.2	16.1	4.1	15.6	16.8
6/11/2013	10/15/2013	18.3	16.8	3.9	16.1	17.5
6/3/2014	10/6/2014	18.9	17.4	4.2	16.9	18.5

As shown in the tables above: (1) water temperature in mainstem Beaver Creek at RM 5.8 and mainstem WF Beaver Creek at RM 0.8 was within the properly functioning range from 2010 to 2014 and (2) water temperature in mainstem Beaver Creek at RM 0.9 was within the properly functioning range from 2010 to 2013 but was in the At-Risk range in 2014. Near record low base flows in summer 2014 may have been a primary factor in high water temperatures and large diurnal temperature variation. It is likely that the rate and magnitude of stream heating and cooling will increase due the 2014 Beaver Fire because: (1) the wildfire burned large swaths of riparian vegetation that had provided shade to stream channels, (2) pools are likely to infill or partially infill with excess sediment which will increase surface area to volume ratio, and (3) the wildfire is likely to significantly increase the frequency of in-channel debris flows and upslope landslides that can remove riparian vegetation and widen-and-shallow stream channels. **At-Risk**.

Sediment - Turbidity: From annual snorkel fish census surveys through the years it is well documented that mainstem Beaver Creek is turbid with fine suspended sediment even after long periods of low flow – underwater visibility is low with a range of about

five or six feet during the most optimal conditions. High watershed disturbance from past vegetation management projects (particularly clearcutting on private timberlands) and the extensive road system are likely the cause of persistent turbidity but no point sorces are known.

The results of 2009, 2010, and 2013 intensive monitoring and evaluation of sediment in mainstem Beaver Creek and mainstem West Fork Beaver Creek that included the metrics: percent surface fines < 2mm, percent sub-surface sediment < 0.85mm, percent sub-surface sedient < 6.38mm, and percent residual pool volume filled with fine sediment (V*), are shown in the three tables in the Substrate Character section below. Substrate quality impairment is evaluated, in part, by comparing the four sediment indicators in mainstems of Beaver Creek and West Fork Beaver Creek to the 85th percentile value of four indicators for reference streams that have minor to negligble management-related watershed disturbance. Watersheds exceeding the 85% percentile of reference streams are considered impaired. One to two sediment indices exceeded reference values in all the sites/survey years that were assessed.

Average surface fines, average sub-surface fines, and average volume of fine sediment filling pools (V*) from the 2010 and 2013 Beaver Creek response reach (beav1) compared to KNF Stream Sediment Monitoring reference conditions (85th percentile). (beav1) metrics over threshold values are bolded.

Sediment Index	2010 beav1 reach average %	2013 beav1 reach average %	Reference Condition (%)
Surface Fines < 2mm	3.0	2.4	6.4
Sub-surface fines < 0.85mm	**18.2**	**18.2**	16.2
Sub-surface fines < 6.38mm	44.2	**47.4**	46.1
Fraction of pools filled with fine sediment < 2mm (V star)	0.053	0.056	0.108

Post 2014 Beaver Fire water quality and sediment conditions in lower mainstem Beaver Creek and lower West Fork Beaver Creek were observed and photographed in the winter after several light to moderate precipitation events: the observations and photographs revealed that (1) turbidity was very high during and long- after precipitation events and (2) large quantities of fine sediment had been delivered to the mainstem which had partially smothered the pre-Fire streambed and salmonid spawning gravels. The 2014 Fire increased the actual rate of surface erosion as well as the modeled rate of surface erosion to well over threshold (USLE = 1.16). Increase in the frequency, magnitude and duration of turbidity due to increased surface erosion due to the 2014 Beaver Fire is likely last for a few years to a decade or more until vegetation gets re-established and ground cover is largely recovered in burned areas. Modeled mass-wasting is over threshold (GEO = 1.07). The rate of mass wasting that can cause bouts of acute turbidity will likely be increased for a decade or more due to decreased evapotranspiration, decreased ground cover, increased groundwater, increased overland flow, and/or loss of soil cohesion provided by living tree roots. **Not Properly Functioning**.

Chemical Contamination: No significant source of chemical contamination is known to exist on National Forest lands. No known significant source of chemical contamination is suspected from private lands. **Properly Functioning**.

HABITAT ACCESS

Physical Barriers: There are no barriers to fish passage. **Properly Functioning**.

HABITAT ELEMENTS

Substrate Character: Substrate character was determined: (1)intensive evaluation of substrate composition in 2009, 2010, and 2013; (2) from CWE modeling; and (3) from personal observation of surface substrate composition after the 2014 Beaver Fire and a few light to moderate rainstorms.

Sediment composition was intensely evaluated at three sites within the Beaver Creek HUC10 watershed since 2009. The metrics evaluated were: percent surface fines < 2mm (medial axis), percent sub-surface sediment < 0.85mm, percent sub-surface sediment < 6.38mm, and percent residual pool volume filled with fine sediment (V*). The results of these evaluations are shown in the tables below. Substrate quality is judged in part by comparing the value of the four sediment indicators in Beaver Creek (a managed watershed) to the 85th percentile value of the indicators for reference streams that have minor to negligble management-related watershed disturbance. Stream reaches exceeding the 85% percentile of reference streams may be impaired. One to two sediment indices exceeded reference values in all the sites/survey years that were assessed.

Average surface fines, average sub-surface fines, and average volume of fine sediment filling pools (V*) from the lower Beaver Creek response reach (beav1) in 2010 and 2013 compared to KNF stream sediment monitoring reference conditions (@85 percentile). beav1 metrics over reference values are bolded.

Sediment Index	2010 beav1 reach average (%)	2013 beav1 reach average (%)	Reference Condition (%)
Surface Fines < 2mm	3	2.4	6.4
Sub-surface fines < 0.85mm	**18.2**	**18.2**	16.2
Sub-surface fines < 6.38mm	44.2	**47.4**	46.1
Fraction of pools filled with fine sediment < 2mm (V star)	0.053	0.056	0.11

Average surface fines, average sub-surface fines, and average volume of fine sediment filling pools (V*) from the upper Beaver Creek response reach (beav2) in 2010 and 2013 compared to KNF stream sediment monitoring reference conditions (@85 percentile). beav2 metrics over reference values are bolded.

Sediment Index	2010 beav2 reach average (%)	2013 beav2 reach average (%)	Reference Condition (%)
Surface Fines < 2mm	3.6	6.3	6.4
Sub-surface fines < 0.85mm	16.0	**19.3**	16.2
Sub-surface fines < 6.38mm	44.0	44.4	46.1
Fraction of pools filled with fine sediment < 2mm (V star)	0.076	0.074	0.11

Average surface fines, average sub-surface fines, and average volume of fine sediment filling pools (V*) from the mainstem West Fork Beaver Creek response reach (wfbea1) in 2009 and 2013 compared to KNF stream sediment monitoring reference conditions (@85 percentile). wfbea1 metrics over reference values are bolded.

Sediment Index	2009 wfbea1 reach average (%)	2013 wfbea1 reach average (%)	Reference Condition (%)
Surface Fines < 2mm	3.1	6.1	6.4
Sub-surface fines < 0.85mm	**16.9**	**20.1**	16.2
Sub-surface fines < 6.38mm	45.6	45.5	46.1
Fraction of pools filled with fine sediment < 2mm (V star)	**0.143**	0.124	0.11

Post 2014 Beaver Fire water quality and sediment conditions in lower mainstem Beaver Creek and lower West Fork Beaver Creek were observed and photographed in the winter after several light to moderate precipitation events: the observations and photographs revealed that (1) turbidity was very high during and long- after precipitation events and (2) large quantities of fine sediment had been delivered to the mainstem which had partially smothered the pre-Fire streambed and salmonid spawning gravels. The 2014 Fire increased the actual rate of surface erosion as well as the modeled rate of surface erosion to well over threshold (USLE = 1.16). Increase in the frequency, magnitude and duration of turbidity due to increased surface erosion due to the 2014 Beaver Fire is likely last for a few years to a decade or more until vegetation gets re-established and ground cover is largely recovered in burned areas. Modeled mass-wasting is over threshold (GEO = 1.07). The rate of mass wasting that can cause bouts of acute turbidity will likely be increased for a decade or more due to decreased evapotranspiration, decreased ground cover, increased groundwater, increased overland flow, and/or loss of soil cohesion provided by living tree roots. **Not Properly Functioning**.

Large Woody Debris: There is no current quantitative information on LWD and potential for future LWD recruitment to the stream, however, according to a 1989 stream survey there was 1.5 pieces of LWD per 1000 lineal feet on the mainstem between the mouth and Grouse Creek. That is well below the 20 pieces/1000 feet that is desired condition in the Forest Plan or the 20 pieces/mile that is the bare minimum for Properly Functioning is the Table of Habitat Indicators. Late in the 1980s it was recognized that there was a lack of sufficient LWD in fish-bearing reaches in the Beaver Creek watershed. By 1996 over 340 LWD structures were installed in the mainstem Beaver, West Fork, and Cow Creeks in an attempt to make up for lack of LWD but these structures have almost entirely been blown out by high water, floods, and debris flows.

Currently and qualitatively, there is very little effective LWD in the mainstem channel and little potential for future LWD recruitment (personal observation made during numerous salmon and steelhead census surveys of mainstem Beaver Creek). The density of LWD in West Fork is greater than that of the mainstem but still well below desired condition.

Existing down LWD and standing large green conifer trees or snags are likely reduced in the stream channel and stream buffer due: (1) a “stream cleaning” program that removed LWD from stream channels after the 1964 Flood, (2) easy access to standing live and dead trees at the very high density of stream crossings, (3) easy access to standing live and dead trees along stretches of valley bottom and inner gorge road within stream buffer RRs, (4) past (Forest Service and private) and current (private) clear cutting close to a stream channel, (5) clearing in the Beaver Creek streamside campground, and (6) clearing and disturbance on private property (about half of the land adjacent to mainstem Beaver Creek is private).

Based on these factors, it is my professional opinion that the LWD indicator is **Not Properly Functioning**.

Pool Frequency and Quality: There were 26 pools in the 6.2 miles of mainstem Beaver Creek within the Buckhorn-Beaver composite watershed that was surveyed in 1989 with an average maximum pool depth of 3.6 feet. Assuming the average bankfull width was 36 feet there was one pool every 35 bankfull widths, however, the frequency of deep pools (over three feet maximum depth) would be less. Pool frequency was low most likely due to lack of LWD, infilling with excessive sediment from a highly disturbed watershed, and/or extirpation of Beaver (Lanman et.al. 2013). These factors still exist today. There is still very little LWD in stream channels and low potential for LWD in the near future. Pool filling from excessive sedimentation is expected to increase over the next ten years or more due to elevated surface erosion and increased mass wasting associated with the 2014 Beaver Fire that burned large swaths of vegetation at moderate to high intensity. Modeled surface erosion and mass wasting risk are over threshold (USLE = 1.28; GEO = 1.16). Sedimentation into Beaver Creek has already significantly increased due to the 2014 Beaver Fire.

Aquatic habitat in Beaver Creek was likely much different before fur trapping and European settlement due to beaver activity. Beaver Creek likely had numerous beaver dams which created pools and prime habitat for salmonids. Pool frequency and quality was likely much higher before trapping and settlement. There are still some beaver left in (or migrated back into) Beaver Creek but the population is slow to rebound probably because of continued trapping but also because of streamside disturbance, lack of in-stream key pieces of LWD, and lack of large recruit-able streamside trees greatly diminishes beaver habitat suitability. **Not Properly Functioning**.

Off-Channel Habitat: Much of the channel of mainstem Beaver Creek is constrained with little potential for floodplain and off-channel habitat development. Most of the unconstrained reaches are on private land where the floodplain is cut-off and the potential for off-channel habitat is restricted by existing roads, berms, and current human activities. There are a few areas where there is functioning off-channel habitat. **At-Risk**.

Refugia: Cold water and cover are the primary elements of salmonid refugia in this watershed. Prior to 2013 summer water temperature was suitable to optimal at all monitoring locations on the mainstem and West Fork. Water temperature was slightly high at the mouth in 2013 and 2014 but still suitable for rearing and for thermal refugia from the Klamath River. Cover is sparse in the lower reaches mainstem Beaver Creek where it is needed most to increase the carrying capacity of the cold thermal refugia. Cover is sparse in these reaches because: (1) the channel has been simplified in order to keep it aligned with the Highway 96 bridge; (2) there are few pools or slack-water areas, and (3) there are few streamside conifer and very little LWD. **At-Risk**.

CHANNEL CONDITION AND DYNAMICS

Width to Depth Ratio: (same discussion as the Pool Frequency/Quality indicator above). **Not Properly Functioning.**

Stream Bank Condition: Streambanks are degraded at: (1) numerous stream crossings, (2) where roads and berms are constructed within the stream buffer and inner gorge, (3) adjacent to

mainstem Beaver Creek where residences have cleared, compacted, or otherwise modified the streambank, and (4) at the campground where the streambank is a berm and where large conifers on the streambank are removed as hazard trees before they have a chance to be recruited to the stream by streamside residents. There are long stretches of road next to mainstem Beaver Creek, West Fork Beaver Creek, and Hungry Creek where the road fill constitutes on bank of the stream. The 2014 Beaver Fire burned 1,977 acres of vegetation in stream buffer RRs at moderate to high intensity. **Not Properly Functioning**.

Floodplain Connectivity: Much of the channel of mainstem Beaver Creek is constrained with little potential for floodplain and off-channel habitat development. Most of the unconstrained reaches are on private land where the floodplain is cut-off and the potential for off-channel habitat is restricted by existing roads, berms, and current human activities. There are a few areas where there is functioning off-channel habitat. **At-Risk**.

FLOW/HYDROLOGY

Change in Peak/Base flow: Modeled runoff risk is just over threshold (ERA/TOC = 1.01) primarily due to vegetation management, roads, and wildfires (in that order). The firelines are mostly not hydrologically-connected. Increased peak flow due to all these factors combined is likely significant. Base flows are reduced in summer due to State-authorized and riparian water diversions. **Not Properly Functioning**.

Increase in Drainage Network: Road density is very high and hydrologic connectivity of the road system to the stream network ranges from 2% to 54% in the eleven HUC14s (see table below) with an average of 18% across all HUC14s in the HUC10. Therefore, there is likely significant increase in drainage network density due to roads. Fire-lines constructed in attempting to suppress the 2008 and 2014 fires have no or minor hydrologic connectivity with the stream network. **Not Properly Functioning.**

Percent of road system hydrologically-connected to stream network by HUC14 watershed	
HUC14 Name	Hydrologically Connected Road
Buckhorn-Beaver	21%
Deer Creek-Beaver Creek	54%
Dutch Creek	36%
Grouse Creek	10%
Hungry Creek	2%
Jaynes Canyon	16%
Lower Cow Creek	11%
Lower West Fork Beaver Creek	22%
Soda Creek-Beaver Creek	10%
Upper Cow Creek	12%
Upper West Fork Beaver Creek	14%

WATERSHED CONDITION

Road Density/Location: Road density is very high at four miles road per square mile watershed. There are over 10 miles of valley-bottom road in the watershed and many additional miles within inner gorge. Not Properly Functioning.

Disturbance History/Regime: Much of the northeast quadrant of the watershed was clearcut logged between 1909 and 1931 using railroads to transport logs out of the drainage. There was a period of intense logging from 1955 to 1995 during which 11, 480 acres were clearcut and much of the present road system was constructed. The forest that has regenerated or was planted has developed into over-dense nearly even-aged conifer stands with low vegetative diversity. Fire suppression likely contributed to the low diversity in these regenerated stands. Much of this even-age stand is industrial timberland and the timber owners have been and are still in the process of clearcutting it. The even-

age stands on National Forest are very dense and starting to self-thin and the Forest Service has been thinning and reducing fuels in some of the stands.

The last major fire before the 2014 Beaver Fire was the 1955 Dutch Fire (a.k.a. the Haystack Fire) that burned about 1,000 acres along the lower reach of mainstem Beaver Creek. Mining and grazing impacts were intense in the early- to mid-1900s and had major impacts on erosional processes and aquatic habitat. The primary effect of historic railroad logging and intense grazing and mining on watershed processes is slow (or no) vegetative regeneration in highly disturbed areas, but the current magnitude of this effect is small and likely has minor impact on the quality of aquatic habitats beyond the site or stream reach scale.

Approximately 21 miles of stream channel was altered by high water and debris flows during the 1997 Flood which is about 10% of all channels in the watershed. The 1997 Flood triggered 67 major road failures in the Beaver Creek watershed some of which caused or contributed to the channel-altering debris flows, and all of which contributed to excessive sediment delivery to stream channels. 1997 Flood-altered channels are likely slow to recover because watershed disturbance is still very high. The 2014 Beaver Fire disturbance has setback recovery of the stream channel and aquatic habitats by increasing the rate of chronic sediment delivery. The 2014 Fire is likely to increase the rate of channel-altering debris flows for the next ten years or longer.

Currently, watershed disturbance is high primarily due to: (1) vegetation management (clear-cutting on private lands and thinning and fuels reduction on National Forest); (2) the high density road system; and (3) the 2014 Beaver Fire that burned approximately 7,407 acres at moderate to high intensity. Several miles of fire-lines were constructed or re-constructed in attempts to suppress the fire. Modeled watershed disturbance is over threshold in all three models at the HUC10 scale: surface erosion risk (USLE = 1.16); mass wasting risk (GEO = 1.07); and runoff risk (ERA/TOC = 1.01). The source of disturbance in the mass wasting model and runoff models is first and foremost from vegetation management projects followed closely by roads with wildfires a not so distant third source. The source of disturbance in the surface erosion model is primarily the road system with wildfire and vegetation management having minor influence. Firelines were a very minor source of disturbance in the surface erosion and runoff models and accounted for less than 4% of the disturbance in the mass wasting model. Not Properly Functioning.

Riparian Reserve: Stream buffer RRs are degraded at: (1) numerous upslope stream crossings and numerous valley bottom and/or inner gorge roads – road density in stream buffer RRs is over 4 miles road per square mile stream buffer RR; (2) the campground (streamside on the mainstem), (3) on private property (about half of the land adjacent to mainstem Beaver Creek downstream from West Fork is private), and (4) on industrial timberlands (nearly half of the Beaver Creek HUC10 is industrial timberland where stream buffers are narrow).

The 2014 Beaver Fire burned 1,977 acres of stream buffer RR at moderate-to-high severity and these areas are in initial or early stage of recovery depending on site condition and site potential. This much moderate and high intensity fire in hydrologic RRs, coupled with a high-density road system, is expected to significantly: (1) decrease

hydrologic retention, (2) decrease the sediment filtering and nutrient spiraling function of riparian vegetation compromising the potential of hydrologic RRs to buffer the stream from upslope ground disturbances and landslides, and (3) increase streamside landsliding.

The 2014 Beaver Fire burned 934 acres of geologic RR as follows: 38 acres active landslide; 192 acres toe-zone; and 704 acres inner gorge. Many of the acres of moderate to high severity burned inner gorge are within the 1,977 acres of stream buffer RR that burned at moderate-to-high severity. Not Properly Functioning.

CHECKLIST FOR DOCUMENTING ENVIRONMENTAL BASELINE AND EFFECTS

OF PROPOSED ACTION(S) ON RELEVANT INDICATORS

PROJECT: **Westside Fire Recovery**

WATERSHED**: Elk Creek**

Pathways: INDICATORS	ENVIRONMENTAL BASELINE **Elk Creek 5th Field watershed**			EFFECTS OF THE ACTION(S) **Elk Creek 5th Field watershed**		
	PROPERLY FUNCT	**AT RISK**	**NOT ROP FUNCT**	**RESTORE**	**MAINTAIN**	**DEGRADE**
Water Quality Temperature		**TEMP**			**X**	
Sediment-Turbidity		**SED KNF CWE PO/PJ**		**X**		
Chemical Contamination	**ND/PO/PJ**				**X**	
Habitat Access Physical Barrier	**FPI**				**X**	
Habitat Elements Substrate Character		**SED KNF CWE PO/PJ**		**X**		
Large Woody Debris		**SS06 KNF GIS PO/PJ**			**X**	
Pool Frequency/Quality		**KNF GIS SS06 PO/PJ**			**X**	
Off-channel Habitat	**NA**					
Refugia		**TEMP SS06 PO PJ**			**X**	
Channel Cond & Dyn Width-to-Depth Ratio		**SS06 Flood PO PJ**			**X**	
Streambank Condition			**KNF GIS Flood PO PJ**		**X**	
Floodplain Condition	**NA**					
Flow /Hydrology Change in Peak/Base		**KNF GIS RSS**			**X**	
Drainage Network Increase		**KNF GIS RSS**		**X**		
Watershed Cond. Road Density/Location		**KNF GIS RSS**			**X**	
Disturbance History/Regime		**KNF GIS Flood RSS**			**X**	
Riparian Reserves			**KNF GIS RSS PO PJ**		**X**	

TEMP = Water temperature monitoring at RM 0.5 and RM 4.5 of mainstem Elk Creek from 1990 to 2014;

SS06 = 2006 KNF stream survey of mainstem Elk Creek from mouth to Bear Creek Confluence (13 miles); **SED =** 2011 sediment assessment survey; **RSS =** 1999 KNF Road Sediment Source Inventory and Risk Assessment; **FPI** = KNF Forest-Wide Fish Passage Barrier Inventory; Flood = KNF analysis of the 1997 New Year Flood; ND = No Data; PJ = Professional Judgement; **PO** = Personal Observation based on 20+ years observing; NA = Not Applicable; **KNF GIS** = KNF GIS database query and CWE modeling for WFR Project (Fall 2014 to Winter 2015);
Environmental Baseline and Checklist last updated by Jon Grunbaum on April 3, 2015.

The Elk Creek 5th-field (HUC10) watershed is a true watershed with an area of 60,829 acres. The Elk Creek watershed is over 97% National Forest land and about 3% private or local government. The national forest land has been used for timber production or is in wilderness. The private land is mostly residential with low ground disturbance, however: one large upslope parcel has a several-acre auto wrecking yard complete with hundreds of old cars and noxious weeds; one streamside several acre parcel is the intake facility and water treatment plant for the town of Happy Camp; and one large (10-20 acres) streamside parcel is a commercial campground. The mainstem of Elk Creek is a 5th-order (Strahler 1957) stream from the mouth to East Fork Elk Creek and a 4th-order stream from East Fork Elk Creek to Granite Creek. Mainstem Elk Creek provides approximately 13 miles of habitat for Coho salmon; 12 miles for fall Chinook salmon; 14 miles for spring Chinook salmon; and steelhead throughout the entire mainstem. Several tributaries to mainstem Elk Creek are fish-bearing: East Fork Elk Creek is 4th-order stream that provides 0.4 miles of habitat for Coho salmon and about 2.5 miles of habitat for steelhead/rainbow trout; Twins Creek (1st-order) provides a couple tenths of a mile of habitat for steelhead/rainbow trout; Cougar Creek (2nd-order) provides a few tenths of a mile of habitat for Coho salmon and steelhead/rainbow trout; Bear Creek provides about 0.5 mile of habitat for steelhead trout and several miles of habitat for rainbow trout (some brook trout higher up in the reaches downstream from Bear Lake); Granite and Rainey Valley Creeks are 2nd-order streams that each provide several tenths of a mile of habitat for steelhead trout and a little more for rainbow trout. The other named tributaries to the mainstem (Stanza, Malone, Doolittle, Johnson, Lick) provide a few tenths or less of habitat for steelhead/rainbow trout. None of the un-named tributaries to the mainstem are fish-bearing. The last stream survey of mainstem Elk Creek was in 2006 and went from the mouth to Bear Creek (13.9 miles). The last stream survey of East Fork Elk was in 1990. Bear, Granite, and Burney Creeks were surveyed in 1994 and 1995. Stream surveys prior to the 1997 Flood are not very reliable for portraying current condition because the 1997 Flood altered many of the stream channels and stream buffer, and altered substrate composition. Channel sediment metrics were assessed in 2009, 2011, and 2012 but those metrics are less reliable now for describing current condition because excess sediment has already been delivered to the channel as a result of the 2014 Fire (but still useful for describing trend).

Elk Creek 5th-field (HUC10) Watershed Environmental Baseline Elements:

WATER QUALITY

Water Temperature: Summer (and some winter) water temperature of mainstem Elk Creek was monitored within the Hoop&Devil HUC14 at approximately RM 4.5 nearly every year since 1990 (no data for 1996). Summer water temperature of the mainstem within the HUC14 was monitored near the mouth at RM 0.5 since 2011. The 1997 flood greatly altered the mainstem channel of Elk Creek – resulting in widening and shallowing of the channel, and loss of streamside vegetation. Much of mainstem Elk and several tributaries to mainstem Elk Creek experienced large debris flows that scoured and altered

their channels and ripped out riparian vegetation. Excess sediment from numerous natural debris torrents, and from over 200 road failures, resulted in excessive bedload which overwhelmed and altered the channel of mainstem Elk Creek. The loss of riparian vegetation and narrowing/widening of the stream channel increased the range and magnitude of daily heating and cooling – as described in the assessment: *The Flood of 1997- Klamath National* Forest (USDA KNF, November 1998). Riparian and channel recovery was still taking place when the 2014 Fire hit. Before the 1997 Flood: from 1990 to 1995, the 7-day maximum water maximum temperature (MWMT) 18.7 ^{o}C to 21.8 ^{o}C, with six-year average of 20.8^{o}C. After the 1997 Flood: from 1997 to 2004, the MWMT ranged from 20.1 ^{o}C to 23.7 ^{o}C, with eight-year average of 22.9^{o}C. Since then, the 2008 Panther Fire burned riparian vegetation and increased water temperatures in tributary watersheds upstream from the Hoop-n-Devil watershed. Much higher than average water temperatures in Klamath River tributaries in 2014, including Elk Creek, was likely the result of record or near record low streamflows. As shown in the table below, in the last five years of monitoring, the maximum instantaneous water temperature at RM 4.5 ranged from 20.2^{o}C to 24.8 ^{o}C; the maximum weekly average temperature (MWAT) ranged from 17.5 ^{o}C to 21.1^{o}C; and the MWMT ranged from 19.6 ^{o}C to 23.8^{o}C, with a five-year average of 21.8 ^{o}C.

Recent Water Temperature Monitoring Results for Mainstem Elk Creek at RM 4.5

Start	End	Max Daily Average Temp C	Max Daily Max Temp C	Min Daily Min Temp C	Max Diurnal Variation Temp C	Maximum Weekly Average Temp C (MWAT)	Maximum Weekly Maximum Temp (MWMT)
7/1/2010	10/21/2010	19.7	22	8.3	5.3	19.0	21.4
7/14/2011	10/11/2011	17.8	20.2	5.3	4.9	17.5	19.6
6/22/2012	10/23/2012	19.5	22.0	7.4	5.2	18.8	21.0
6/8/2013	11/3/2013	21.5	24.4	5.9	6.2	20.5	23.0
5/28/2014	9/24/2014	21.8	24.8	10.3	6	21.1	23.8

As shown in the table below, in the last four years of monitoring, the maximum instantaneous water temperature at RM 0.5 ranged from 20.4^{o}C to 25.3 ^{o}C; the maximum weekly average temperature (MWAT) ranged from 18.0 ^{o}C to 22.1^{o}C; and the MWMT ranged from 19.8 ^{o}C to 24.3^{o}C, with a five-year average of 21.8 ^{o}C.

Recent Water Temperature Monitoring Results for Mainstem Elk Creek at RM 0.5

Start	End	Max Daily Average Temp C	Max Daily Max Temp C	Min Daily Min Temp C	Max Diurnal Variation Temp C	Maximum Weekly Average Temp C (MWAT)	Maximum Weekly Maximum Temp (MWMT)
6/11/2011	10/4/2011	18.5	20.4	7.3	4.7	18.0	19.8
6/8/2012	10/23/2012	20.1	21.8	7.8	4.9	19.5	20.9
6/6/2013	9/25/2013	22.3	24.4	11.4	5.2	21.3	23.2
5/23/2014	9/30/2014	**22.8**	**25.3**	**10.9**	**5.5**	**22.1**	**24.3**

Therefore, the condition of the Water Temperature indicator is **At-Risk** bordering on Not Properly Functioning.

Sediment - Turbidity: The 2008 Panther Fire significantly elevated the magnitude and duration of turbidity in mainstem Elk Creek (personal observation). This increase in turbidity was generally subsiding when the 2014 Fire hit. The 2014 Fire again

significantly elevated the magnitude and duration of turbidity in mainstem Elk Creek during peak runoff events (personal observation). Chronic turbidity is likely to remain elevated for several more years until vegetation and duff recovers ground cover again. Acute fire-related turbidity in mainstem Elk Creek is expected to be elevated for up to ten years or longer because mass wasting/debris flows are expected to significantly increase in 2014 wildfire burned areas in that period of time. Modeled surface erosion is slightly elevated (USLE = 0.30) in the Elk Creek HUC10 and moderately to highly elevated in the three East Fork Elk Creek HUC14s that drain into the the mainstem. Modeled wasting is at threshold (GEO = 0.98). **At-Risk**.

Chemical Contamination: No significant source of chemical contamination is known to exist other than an auto wrecking yard on private property (which is not known to be point source of water contamination). **Properly Functioning**.

HABITAT ACCESS

Physical Barriers: No barriers to fish passage were found in the KNF Fish Passage Inventory (KNF 2003). **Properly Functioning**.

HABITAT ELEMENTS

Substrate Character: Substrate character was determined from a 2006 stream survey, intensive evaluation of streambed sediment composition, existing watershed disturbance levels as described under the *Disturbance History/Regime Indicator* below; and personal observation and judgment.

During the 2006 stream survey, in the mainstem reach from the mouth to EF Elk Creek: (1) surface fines in pebble counts averaged 6.9%; (2) surface fines in pool tail-outs averaged 8.1%, and (3) embeddedness averaged 26.4%. The values of surface fines were within desired range for properly functioning streams but embeddedness slightly exceeded desired range.

During the 2006 stream survey, in the mainstem reach from EF Elk Creek to Bear Creek: (1) surface fines in pebble counts averaged 9.0%; (2) surface fines in pool tail-outs also averaged 9.0%, and (3) embeddedness averaged 27.5%. The values of surface fines were within desired range for properly functioning streams but embeddedness slightly exceeded desired range.

Sediment composition was intensely evaluated at three sites within the Elk Creek HUC10 watershed since 2009. The metrics evaluated were: percent surface fines < 2mm (medial axis), percent sub-surface sediment < 0.85mm, percent sub-surface sediment < 6.38mm, and percent residual pool volume filled with fine sediment (V*). The results of these evaluations are shown in the table below. Substrate quality is judged in part by comparing the value of the four sediment indicators in Elk Creek (a managed watershed) to the 85th percentile value of the indicators for reference streams that have negligble management-related watershed disturbance. Stream reaches exceeding the 85% percentile of reference streams may be impaired.

Average surface fines, average sub-surface fines, and average volume of fine sediment filling pools (V*) from the 2011 East Fork Elk Creek response reach (efelk1) compared to KNF Stream Sediment Monitoring reference conditions (@85 percentile). efelk1 metrics over reference values are bolded.

Sediment Index	efelk1 reach average (%)	Reference Condition (%)
Surface Fines < 2mm	**9.0**	6.4
Sub-surface fines < 0.85mm	15.2	16.2
Sub-surface fines < 6.38mm	45.6	46.1
Fraction of pools filled with fine sediment < 2mm (V star)	0.065	0.11

Average surface fines, average sub-surface fines, and average volume of fine sediment filling pools (V*) from the 2011 Elk Creek response reach (elk2) compared to KNF Stream Sediment Monitoring reference conditions (@85 percentile). elk2 metrics over reference values are bolded.

Sediment Index	elk2 reach average (%)	Reference Condition (%)
Surface Fines < 2mm	**6.7**	6.4
Sub-surface fines < 0.85mm	**18.9**	16.2
Sub-surface fines < 6.38mm	36.6	46.1
Fraction of pools filled with fine sediment < 2mm (V star)	0.05	0.11

Average surface fines, average sub-surface fines, and average volume of fine sediment filling pools (V*) from the 2009 and 2012 Elk Creek response reach (elk4) that is just upstream of Bear Creek confluence compared to KNF Stream Sediment Monitoring reference conditions (@85 percentile). Elk4 metrics over reference values are bolded.

Sediment Index	2009 elk4 reach average (%)	2011 elk4 reach average (%)	Reference Condition (%)
Surface Fines < 2mm	4.2	3.8	6.4
Sub-surface fines < 0.85mm	**20.8**	**17.7**	16.2
Sub-surface fines < 6.38mm	**61.6**	**56.2**	46.1
Fraction of pools filled with fine sediment < 2mm (V *)	**0.121**	0.043	0.11

The area of streambed covered by sand, and the size of sandbars, in mainstem Elk Creek has been noticeably increasing since the 2008 Panther Fire and more recently the 2014 Happy Camp Complex (personal observation from frequent fish/stream surveys and kayak trips down mainstem Elk Creek over the last 20 years). Surface erosion and chronic sedimentation into streams that drain 2014 wildfire burned watersheds is likely to be elevated for several years until vegetation and duff recovers ground cover in areas that burned at moderate-to-high intensity. The rate of mass wasting and debris flows is expected to increase for up to ten years or longer until ground cover increases and the roots of recovering vegetation regain the capacity to bind soil in areas that burned at moderate-to-high intensity. Modeled surface erosion is slightly elevated (USLE = 0.30) in the Elk Creek HUC10 and moderately to highly elevated in the three East Fork Elk Creek HUC14s that drain into the the mainstem. Modeled wasting is at threshold (GEO = 0.98). **At-Risk**.

Large Woody Debris: During the 2006 stream survey of mainstem Elk Creek from the mouth to Bear Creek (about 13.5 stream miles) there were only eight pieces of LWD. However, the potential for future LWD recruitment was near site potential between RM 0.7 and RM 3.8; and between RM 4.3 to RM 13.6. In fact, many large trees along these reaches did fall into mainstem Elk Creek during heavy snowfall in winter 2012-13. Along mainstem Elk Creek from the mouth to EF Elk Creek there was an estimated 107

recruitable (over 24" dbh) trees per miles; along mainstem Elk Creek from EF Elk to Bear Creek there was an estimated 126 recruitable trees per mile. The potential for future LWD recruitment and for recruited LWD to be left in the stream is greatly diminished along the lower 0.7 mile of Elk Creek mainstem due to the existence of the Happy Camp community water treatment plant, a campground, private residences, roads and a bridge, and an off-road ATV play area in the stream buffer. The potential for future LWD recruitment and for recruited LWD to be left in the stream is greatly diminished from RM 3.8 to RM 4.3 of Elk Creek mainstem due to private residences, roads, and a bridge in the stream buffer. The potential for future LWD recruitment and for recruited LWD to be left in the stream buffers of tributaries to mainstem Elk Creek is moderate to high because most tributary watersheds have low-moderate disturbance in the stream buffers. Many trees within one site potential tree height distance from a channel that were killed or damaged by the 2008 and/or 2014 wildfires are likely to be recruited into the stream over the next ten years or so. **At-Risk**.

Pool Frequency/Quality: In the 2006 stream survey of mainstem Elk Creek from the mouth to EF Elk Creek there was one deep (over three feet maximum depth) pool every 5.6 bankfull widths with an average maximum depth of 6.6 feet; and maximum pool depth ranged from 3.5 to 13.9 feet. In the 2006 stream survey of mainstem Elk Creek from EF Elk Creek to Bear Creek there was one deep (over three feet maximum depth) pool every 7.5 bankfull widths with an average maximum depth of 5.8 feet; and maximum pool depth ranged from 2.7 to 11.4 feet. Excessive fines that are being delivered to mainstem Elk Creek as a result of the 2008 Panther Fire and 2014 Happy Camp Complex fire have significantly increased the size of sandbars in pools reducing residual pool volume (last personal observation made in middle of January 2015). It is likely that pools will continue to fill over the next few to ten years due to increased rate of surface erosion and mass wasting from areas of the watershed that burned at moderate to high severity. **At-Risk**.

Off-Channel Habitat: Generally NA to the Rosgen C-, G-, and F-Channel types in mainstem Elk Creek. Off-channel habitats are not characteristic of these channel types. There are few unconstrained areas – all unconstrained areas are private land. **NA**

Refugia: Cold water and cover are the primary elements of fish refugia in this watershed. Water temperature is slightly high due to channel-widening and loss of vegetation during the 1997 Flood and from loss of stream-shading vegetation in the 2008 Panther Fire. The 2014 Happy Camp Complex fire burned many acres of stream buffer RR which will likely lead to further increases in peak high temperatures. LWD is below desired condition in the lower 0.7 mile of mainstem Elk Creek where rufugia cover is most needed for fish trying to escape high water temperatures in the Klamath River. There are frequent deep pools that provide good cover. **At-Risk**.

CHANNEL CONDITION AND DYNAMICS

Width to Depth Ratio: Approximately 28% of stream channels in the Elk Creek watershed were altered by high water and debris flows during the 1997 Flood. Most of mainstem Elk Creek was scoured and overwhelmed with excess sediment and pools were completely or partially filled with sediment. Most of the channel of mainstem Elk Creek is constrained and excessive sediment from the 1997 Flood has largely been transported out based on the 2006 pool frequency/quality data and personal observation. Many of the

flood-altered channel reaches were in tributaries where debris flows altered channel cross-section from V-shape to U-shape. 1997 Flood altered tributary reaches were well on the way to recovery when the 2008 Panther Fire and then the 2014 Happy Camp Complex wildfires hit. Currently, excessive delivery of fines due to the 2008 and 2014 wildfires is filling pools thereby reducing pool volume and mean pool depth. The 2008 and 2014 fires are likely to increase the rate of landsliding and mass wasting which in turn could lead to more altered channel and pool infilling with course sediment. **At-Risk**.

Stream Bank Condition: Much of the streambank of mainstem Elk Creek was scoured and altered during the 1997 Flood event, however, most (over 90%) of the mainstem reaches are constrained with bedrock banks that have largely recovered to site potential from the flood. Streamside vegetation was largely ripped out and the streambanks were altered in the few unconstrained reaches. Recovery of vegetation and streambanks in unconstrained reaches is well underway and most streamside alder trees are still small having only sprouted or germinated in 1998 and have limited ability to stabilize the streambank. The 2014 wildfire burned 1,743 acres of stream buffer RR at moderate to high severity which is approximately 15.2% of the stream buffer in the Elk Creek watershed. Vegetation was killed or burned off streambanks in these areas and will take years to decades to recover. **Not Properly Functioning**.

Floodplain Connectivity: Generally NA to the Rosgen C-, G-, and F-Channel types in mainstem Elk Creek. Floodplains are not characteristic of these channel types. There are few unconstrained areas – all unconstrained areas are private land. **NA**.

FLOW/HYDROLOGY

Change in Peak/Base flow: Modeled runoff risk is moderately elevated (ERA/TOC = 0.51) primarily due to past wildfires, roads, vegetation management, and firelines (in that order). The firelines are mostly not hydrologically-connected. Increased peak flow due to all these factors combined is likely minor. Base flows are reduced in summer due to riparian water rights and municipal water diversion from mainstem Elk Creek. Municipal demand can divert as much as 1.5 million gallons of water per day – this water is diverted at about RM 0.6. **At-Risk**.

Increase in Drainage Network: Road density is moderate to high in 8 of the 12 HUC14s within the Elk Creek HUC10; and very low or zero in the other five HUC14s. Hydrologic connectivity of the road system to the stream network ranges from 10% to 47% in the eight roaded HUC14s. Therefore, there is low to moderate increase in drainage network density due to roads. Fire-lines constructed in attempting to suppress the 2008 and 2014 fires have no or minor hydrologic connectivity with the stream network. **At-Risk**.

WATERSHED CONDITION

Road Density/Location: Road density is low to moderate at one mile road per square mile watershed. There are over 13 miles of valley-bottom road in the watershed. **At-Risk**.

Disturbance History/Regime: The entire length of the stream channel of mainstem Elk Creek was altered by debris flows from road failures and/or natural landslides during the 1997 Flood, and is still recovering. The 1997 Flood triggered 135 major road failures in the Elk Creek watershed some of which caused or contributed to channel-altering debris

flows. 1997 Flood-altered channels were well on the way to recovery when the 2008 Panther Fire and 2014 Happy Camp Complex Fires hit.

Currently, watershed disturbance is high primarily because of the 2008 Panther Fire that burned approximately 18,000 acres mostly at moderate to high intensity, and the 2014 Happy Camp Complex which burned 7,762 acres (12.8% of the watershed) at moderate to high intensity. Several miles of fire-lines were constructed or re-constructed in attempts to suppress these fires. Modeled surface erosion is slightly elevated (USLE = 0.30); modeled wasting is at threshold (GEO = 0.98); and modeled runoff risk is moderately elevated (ERA/TOC = 0.51). Disturbance in the models is primarily due to wildfire and roads (in that order). Firelines account for a small fraction (less than 5%) of the modeled disturbance. **At-Risk**.

Riparian Reserve: The stream buffer RR of mainstem Elk Creek is largely intact between RM 0.7 and RM 3.8 because there are no valley bottom roads, stream crossings, or development along this section of mainstem. The stream buffer RR of mainstem Elk Creek is largely intact between RM 4.3 and RM 13.9 because there are few valley-bottom roads, stream-crossings, or development along these reaches. The stream buffer of mainstem Elk Creek is significantly impacted along the lower 0.7 mile of Elk Creek mainstem due to the existence of the Happy Camp community water treatment plant, a campground, private residences, valley-bottom roads, a bridge, and an off-road ATV play area at the mouth. The stream buffer of mainstem Elk Creek is slightly impacted from RM 3.8 to RM 4.3 due to private residences, roads, and a bridge in the stream buffer.

Road density is low at the HUC10 scale because four of the 13 HUC14s are in wilderness where there are no roads. Several of the HUC14s outside of wilderness have moderate to high road density though.

The 2014 Happy Camp Complex fire burned 1,521 acres of stream buffer RR (15.2% all of stream buffer RR in the HUC10) at moderate-to-high severity and these areas are still in initial or early stage of recovery depending on site condition and site potential. Many acres of stream course RRs burned at moderate to high intensity during the 2008 Panther Fire and these areas are still in early to late stages of recovery depending on site condition.

The 2014 Happy Camp Complex fire burned 790 acres of geologic RR as follows: 18 acres active landslide; 5 acres toe-zone; and 767 acres inner gorge. Many of the acres of moderate to high severity burned inner gorge are within the 1,521 acres of stream buffer RR that burned at moderate-to-high severity. **Not Properly Functioning**.

CHECKLIST FOR DOCUMENTING ENVIRONMENTAL BASELINE AND EFFECTS OF PROPOSED ACTION(S) ON RELEVANT INDICATORS
PROJECT: **Westside Fire Recovery**
WATERSHED: **Horse Creek-Klamath River**

Pathways: INDICATORS	ENVIRONMENTAL BASELINE Horse Creek-Klamath River HUC10 *			EFFECTS OF THE ACTION(S) Horse Creek-Klamath River HUC10 *		
	Properly Functioning	**At Risk**	**Not Properly Functioni**	**Restore**	**Maintain**	**Degrade**
Water Quality Temperature			TEMP TMDL		X	
Sediment – Turbidity			KNF GIS TMDL PO/PJ		X	
Chemical/Nutrient Contamination			TMDL		X	
Habitat Access Physical Barrier		FPI/PO/ PJ			X	
Habitat Elements Substrate Character		KNF GIS TMDL			X	
Large Woody Debris			ND/PO/ PJ		X	
Pool Frequency/Quality		ND/PO/PJ			X	
Off-Channel Habitat			PO/PJ		X	
Refugia		TMDL PO/PJ			X	
Channel Cond & Dyn Width-to-Depth Ratio		ND/PO/ PJ			X	
Streambank Condition		PO/PJ			X	
Floodplain Condition			PO/PJ		X	
Flow /Hydrology Change in Peak/Base Flow			TMDL KNF GIS		X	
Drainage Network Increase		KNF GIS			X	
Watershed Cond. Road Density/Location			KNF GIS		X	
Disturbance History/Regime		KNF GIS			X	
Riparian Reserves			KNF GIS		X	

TEMP = Water temperature monitoring of mainstem Klamath River upstream of Scott River (at downstream drain of Horse Creek-Klamath River HUC10); **TMDL =** These indicators are impaired according to USEPA Clean Water Act Section 303(D) for exceeding allowable Total Maximum Daily Loads (TMDLs) of pollutants – SEE Klamath RIVER TMDL; **ND** = No Data; **NA** = Not Applicable; **PO** = Personal Observation; **PJ** = Professional Judgment; **FPI** = KNF

Forest-Wide Fish Passage Barrier Inventory; **RSS** = Road Sediment Source surveys (KNF 1999-2013); **KNF GIS** = KNF GIS database query and CWE modeling for WFR Project (Fall 2014 to Winter 2015);
Environmental Baseline completed by Jon Grunbaum on April 15, 2015.

* = This environmental baseline describes the watershed condition of the Horse Creek-Klamath River HUC10. Specifically, this environmental baseline describes the condition of aquatic habitat and water quality in the Klamath River and watershed conditions throughout the HUC10. Appendices to this environmental baseline are HUC14 environmental baseline summary tables that summarize the condition of aquatic habitat and watershed in the HUC14 tributary reaches that are known to support salmon. These HUC14s are: Lower Horse Creek and Middle Horse Creek (completed descriptive versions of these HUC14 environmental baselines are available in the project record).

Horse Creek-Klamath River 5th-Field (HUC10) Environmental Baseline Elements:

Water Quality

Water Temperature: The mainstem Klamath River exceeds the water temperature TMDL (CA State Water Board, 2010). Summer water temperature of the mainstem Klamath River was monitored from 2011 to 2014 just upstream of the confluence of Horse Creek (which is the downstream drain of the Horse Creek-Klamath River HUC10). In the four year period of record the maximum instantaneous water temperature ranged from 25.0^{o}C to 27.3^{o}C; the maximum weekly average temperature (MWAT) ranged from 23.0^{o}C to 25.3^{o}C; and the maximum weekly maximum temperature ranged from 24.6^{o}C to 26.8^{o}C. **Not Properly Functioning**.

Recent Water Temperature Monitoring Results for Mainstem Klamath River Upstream of Scott River Confluence						
Start	**End**	**Max Daily Max Temp C**	**Max Average Daily Temp C**	**Max Diurnal Variation Temp C**	**Maximum Weekly Average Temp C (MWAT)**	**Maximum Weekly Maximum Temp C (MWMT)**
6/28/2011	10/2/2011	25.0	23.4	3.7	23.0	24.6
6/20/2012	10/15/2012	25.8	24.3	4.1	23.8	25.3
5/17/2013	10/1/2013	26.7	25.1	4.5	24.7	26.1
5/29/2014	10/6/2014	27.3	25.7	4.3	25.3	26.8

Sediment - Turbidity: Even before the 2014 Beaver Fire the mid-Klamath River would become quite turbid during moderate to heavy precipitation and runoff events and remain turbid for long periods thereafter. However, the magnitude and duration of turbidity had actually been decreasing over the 20 years preceding the 2014 Fires (personal observation). Much of the pre-2014 Fires turbidity was due to high levels of disturbance from an era of intense logging and road construction (1955 – 1995) in the Horse Creek-Klamath River HUC10 and in many areas within the HUC10s upstream of the Horse Creek-Klamath River HUC10. The 1987 Fires also likely contributed to the turbidity. HUC10s upstream of Iron Gate Dam contribute very little sediment or turbidity to the mainstem Klamath River because the deep volcanic soils do not facilitate much overland flow and because the dam acts as a settling basin.

Thousands of acres of forest that drain into the reach of the mid-Klamath River that flows through the Horse Creek-Klamath River HUC10 burned at moderate to high severity in the 2014 Beaver Fire. Much of the northeast quadrant of the Horse Creek-Klamath River HUC10 burned at moderate to high severity; and a large area in the southwest quadrant of the Beaver Creek HUC10 (which is upstream of the Horse Creek-Klamath River HUC10)

burned at moderate to high severity. The 2014 Fires have already greatly increased the rate of sediment delivery into streams and increased the magnitude and duration of turbidity events. The frequency, magnitude and duration of 2014 Fires-related turbidity is likely to be significantly elevated for at least the next few years until vegetation gets re-established and ground cover increases, and excess fines are winnowed out of the system. Risk of landslides that can cause bouts of acute turbidity will likely be increased for a decade or more due to decreased evapotranspiration, decreased ground cover, increased groundwater, increased overland flow, and/or loss of soil cohesion provided by living tree roots. Modeled surface erosion risk (USLE = 0.81) and mass wasting risk (GEO = 0.86) are high in the Horse Creek-Klamath River HUC10. Modeled surface erosion risk (USLE = 1.16) and mass wasting risk (GEO = 1.07) are over threshold in the (upstream) Beaver Creek HUC10. **Not Properly Functioning**

Chemical/Nutrient Contamination: The Klamath River mainstem is listed under the US-EPA Section 303(d) of the Clean Water Act as exceeding TMDL for water temperature, nutrients, and organic enrichment/low dissolved oxygen. Industrial and municipal point sources, agricultural runoff, water impoundment, flow regulation and modification, and natural and non-point sources are implicated for the high nutrient and organic enrichment loads, and low dissolved oxygen concentration. Chemical contamination (from fertilizers, pesticides, pharmaceuticals, heavy metals, solvents, etc.) can reasonably be expected to accompany agricultural return flows, and municipal and industrial point sources. Most organic enrichment of the mid-Klamath River occurs upstream of the Horse Creek-Klamath River HUC10 - in the upper Klamath, Scott, and Shasta River basins. The mainstem Klamath River has its origins in the naturally warm shallow eutrophic Upper Klamath Lake that is rich in nutrients and organic matter. However, considerably more nutrient and organic matter is delivered to the mainstem in tailwater from grazing and agriculture occurring throughout the upper Klamath, Scott, and Shasta River basins, and from urban effluent. Excess nutrients and water impoundment is suspected of causing intense blooms of a toxic blue-green algae (cyanobacteria) in Iron Gate Reservoir and other impoundments upstream of Iron gate Reservoir. Toxic algae (or toxin from burst cyanobacteria) from these impoundments has been entrained throughout the entire length of the mid- and lower mid-Klamath River nearly every summer since 2005. The mid-Klamath tributaries within the Horse Creek-Klamath River HUC10 contribute relatively nutrient-poor chemical contamination-free water to the river, although nutrients are likely elevated in Horse Creek due to extensive grazing on former floodplains in the lower valley. **Not Properly Functioning**.

Habitat Access

Physical Barriers: There are few fish passage problems of much significance on National Forest land. The Klamath River Highway 96 makes access to some tributaries difficult. **At-Risk.**

Habitat Elements

Substrate Character: Even before the 2014 Beaver Fire, many Klamath River tributary drainages in the Horse Creek-Klamath River HUC10 and in upstream had elevated erosion and sedimentation rates, and moderate to high modeled Cumulative Watershed Effects (**CWEs**), primarily due to roads, past timber harvest, and mining on all-lands, and

to clearing and development on private land. Thousands of acres of forest that drain into the reach of the mid-Klamath River that flows through the Horse Creek-Klamath River HUC10 burned at moderate to high severity in the 2014 Beaver Fire. The 2014 Beaver Fire has already greatly increased the rate of sediment delivery into streams and the Klamath River (personal observation). The frequency, magnitude and duration of chronic elevated sediment delivery from surface erosion from the 2014 Fire is likely to be remain elevated for at least the next few years until vegetation gets re-established and ground cover increases, and excess fines are winnowed out of the system. The risk of acute bouts of elevated sediment delivery from mass wasting resulting from the 2014 Fire will be increased for a decade or more due to decreased evapotranspiration, decreased ground cover, increased groundwater, increased overland flow, and/or loss of soil cohesion provided by living tree roots. Modeled surface erosion risk (USLE = 0.81) and mass wasting risk (GEO = 0.86) are high in the Horse Creek-Klamath River HUC10. Modeled surface erosion risk (USLE = 1.16) and mass wasting risk (GEO = 1.07) are over threshold in the (upstream) Beaver Creek HUC10.

Sediment character and regime in the Klamath River is also adversely affected by water diversions and hydropower operations (dams) up-river which: (1) adversely affects sediment transport processes in the river below the diversions and dams by decreasing stream flow and the river's ability to move sediment and to self-cleanse and (2) adversely affects sediment transport processes by preventing sediment delivery from the upper basin (above Iron Gate Dam) to the lower basin. **At-Risk**

Large Woody Debris: Because the channel of the mainstem Klamath River is so wide, even whole trees with rootwads attached often do not remain in the channel for long periods before being transported downstream by high flows, however, current levels of LWD in the mainstem Klamath River are likely considerably reduced from pre-settlement levels. Most of the type of LWD that does tend to have long in-channel residence time results from large streamside conifers that fall over into the stream with the rootwad still attached and rootwad still on the streambank or hillslope. The capacity to grow large streamside conifers and the potential for future LWD recruitment to the river has been significantly reduced within the Horse Creek-Klamath River HUC10 because trees within or adjacent to the stream buffer RR are readily accessible to the public (permitted or not) and agencies via the Klamath River Highway that closely parallels much of the mainstem length, via the old Klamath River Highway that runs along the opposite side of the river, via river accesses and other public roads, and via riverfront private property which comprises the majority of ownership in this HUC10. Road construction and maintenance (including hazard tree removal) in stream buffers prevents large trees from growing and removes large trees that might have become LWD. On many of the streamside private properties, current land use practices removes large trees that could recruit to the river and/or preclude the growth of large trees. Compared to pre-settlement conditions, there are fewer and/or smaller logs being delivered to the mainstem from tributary watersheds because of road construction and maintenance within stream buffer, past clearcut logging within stream buffers, and clearing and/or development on private land within stream buffers. **Not Properly Functioning**

Pool Frequency and Quality: Reduction of mainstem pool depth and volume due to infilling is likely occurring because: (1) excessive sediment has been delivered to the mainstem from numerous areas of high watershed disturbance upstream in the mid-

Klamath sub-basin and the Scott River watershed and (2) reduced magnitude and duration of flow in the mainstem (due to upstream water management and hydropower operations) has reduced sediment transport capability. Pool quality may be reduced because of lack of LWD. **At-Risk**.

Off-Channel Habitat: The constrained channel types characteristic of much of the mid-Klamath River generally do not have broad floodplains and do not allow much development of off-channel habitat. The only major unconstrained reach of the mainstem in the Horse Creek-Klamath River HUC10 is north of the river just upriver from Horse Creek but the nearly entire reach is currently a gravel mining operation and major stream crossing for the Klamath River Highway 96. Berms to protect the gravel mining operation and berms to protect the Klamath River Highway prevent the river from interacting with its (historical) floodplain and from developing off-channel habitats. There are also numerous small relatively unconstrained channel reaches that have been impacted by historical industrial dredging that eliminated and continue to preclude development of off-channel habitat. Access to other mainstem floodplain/off-channel habitat areas is adversely affected by altered flow regime from upstream water diversions and hydropower operations. Decreased flows from up-river have decreased hydrologic connectivity between the river and off-channel habitats/floodplains, have reduced the size and temporal duration of these habitats, and have decreased ease of access to and from these critical rearing areas by juvenile salmon and steelhead. Lower Horse Creek is the only other major unconstrained valley reach in the HUC10. In the mid-1900s, lower Horse Creek was tightly constrained against the hillslope by a berm that was constructed to keep Horse Creek from flooding pasture that now exists on the former floodplain. **Not Properly Functioning**

Refugia: This section of the Klamath River provides spawning, rearing, and migration habitats for salmon, steelhead trout, and other anadromous and resident fish species. Poor water quality in the mainstem Klamath River has been physically documented through monitoring (as is described in the Environmental Baselines in the Indicator analyses for Water Temperature, Turbidity, Substrate, and Chemical Contamination) and biologically evidenced by frequent fish kills and high incidence of disease and mortality. Water temperatures in the Klamath River mainstem reach critically high levels for salmonids in summer and salmonids must find cooler water on hot days or during hot periods in order to survive. Klamath River summer thermal refugia is associated with tributaries having cool clear water. Cool, clear, un-polluted water from (most) mid-Klamath River tributaries function to maintain or improve water quality in the mid-Klamath River in summer. Unfortunately, flow and water quality from some of the tributaries is diminished in summer due to water diversion. Winter refugia from high water has been eliminated or degraded by past industrial dredging and berming (see Off-Channel Habitat indicator discussion). **At-Risk**.

Width-to-Depth Ratio: Reduction of mainstem pool depth and volume due to infilling is likely occurring because: (1) excessive sediment has been delivered to the mainstem from numerous areas of high watershed disturbance upstream in the mid-Klamath sub-basin and the Scott River watershed and (2) reduced magnitude and duration of flow in the mainstem (due to upstream water management and hydropower operations) has reduced sediment transport capability. Historical industrial dredging along several channel

reaches, and a current gravel mining operation have altered sections of channel. The channel of Lower Horse Creek has been constrained by berming. **At-Risk**.

Streambank Condition: There are roads in the riparian buffer on both sides of the river – some of the road sections are directly adjacent to the river or within inner gorge so that the road fill or revetment composes the "streambanks". Much of the land adjacent to the Klamath River and lower Horse Creek is private and has had riparian vegetation on streambanks cleared or greatly reduced, and wetlands converted, to enable grazing, farming, or other uses. Grazing occurs on the streambank in the vicinity of Horse Creek and keeps the riparian zone denuded of vegetation. Historic large-scale industrial dredging has overturned the streambed and streambanks in many locations leaving large piles of dredge tailings as "streambanks" that will not support vegetation and that blocks the rivers interaction with its floodplain - resulting in significant diminishment of off-main-channel aquatic habitats. The "streambank" of lower Horse Creek is a berm. There is high density of roads in stream buffer RRs and high density of stream crossings in many of the tributary watersheds. Hundreds of acres of riparian vegetation in hydrologic RRs burned at moderate to high severity in the 2014 Beaver Fire. **At-Risk**.

Floodplain Connectivity: See discussion for Off-Channel Habitat indicator above. **Not Properly Functioning.**

Flow/Hydrology

Change in Peak/Base Flow: The flow regime in the mid-Klamath River is altered by numerous water diversions and hydropower operations that are mostly upstream from the Horse Creek-Klamath River HUC10. However, there are also numerous water diversions from tributaries within the Horse Creek –Klamath River HUC10. Adverse changes in river flow regime have resulted in less water in spring/summer when juvenile anadromous salmonids need to migrate to the ocean and/or to access off-channel habitats. Peak flows in the Klamath River tributaries are elevated from roads, past timber harvest, past wildfires, and other ground compaction/disturbance throughout the Klamath Basin. The 2014 Beaver Fire is expected to increase peak flows in tributaries where large swaths of forest burned at moderate to high intensity. Modeled runoff risk is moderately elevated (ERA/TOC = 0.73). The flow regime in the mid-Klamath River is Not Properly Functioning because of significant water diversion and flow regulation by dams. The flow regime in tributaries in not properly functioning because of excessive water diversion in summer and increased peak flows in winter**. Not Properly Functioning**

Drainage Network Increase: The Klamath River corridor has moderate to high road density, many miles of valley bottom and inner gorge road, and private and public development that has compacted the ground. Many of the tributary watersheds also have moderate to high road densities. There is significant potential for hydrologic connectivity of these compacted areas with the stream network and increase in extent of drainage network. **At-Risk**.

Watershed Conditions

Road Density/Location: Many of the tributary watersheds within the Horse Creek-Klamath River HUC10 have moderate to high road densities. The valley-bottom Klamath River Highway closely parallels the river for much of its' length in the HUC10 and the valley-bottom/inner gorge Old Klamath River Highway runs along the opposite side of

the river for much of the length as well. There are miles of valley-bottom/inner gorge road in the tributaries as well, particularly in the Horse Creek watershed. There are numerous private roads in stream buffers and river accesses throughout the HUC10. **Not Properly Functioning**

Disturbance History/Regime: Many of the HUC14 watersheds in the Horse Creek-Klamath River HUC10 have moderate to high CWEs due primarily to roads, past timber harvest, wildfires, and/or historic large-scale mining. There is moderate to high road density within the river corridor and localized areas of disturbance in the stream buffer associated with stream crossings and established public vehicular river accesses, plus private and unauthorized roads. Roads parallel both sides of the river for most of its length in the HUC10 and many miles are constructed within the actively eroding Klamath River canyon inner gorge. The mid- Klamath River corridor has been impacted in places by historic large-scale hydraulic mining operations that have left lasting imprints on lower slopes adjacent to the river and large mounds of dredge tailings in the stream channel and stream buffer. The 2014 Beaver Fire burned thousands of acres at moderate to high severity. Modeled watershed disturbance is moderately to highly elevated due to roads, the 2014 Fire, vegetation management, and firelines – in that order: surface erosion risk (USLE = 0.81); mass wasting risk (GEO = 0.86); and runoff risk (ERA/TOC = 0.73). **At-Risk.**

Riparian Reserves: There are roads in the riparian buffer on both sides of the river. Much of the land adjacent to the Klamath River and lower Horse Creek is private and has had riparian vegetation cleared or greatly reduced, and wetlands converted, to enable grazing, farming, or other uses. Noxious weed species have invaded the river bars. Historic large-scale industrial dredging has overturned the streambed in many locations leaving large piles of dredge tailings that will not support vegetation and that blocks the rivers interaction with its floodplain - resulting in significant diminishment of off-main-channel aquatic habitats. Within the largest (historically) unconstrained reach of the river there is a large gravel mining operation that does not support vegetation and prevents the river from interacting with its floodplain - resulting in significant diminishment of off-main-channel aquatic habitats. There is high density of roads in RR and stream crossings in in many of the tributary watersheds. Hundreds of acres of vegetation in hydrologic RRs and geologic RRs burned at moderate to high severity in the in the 2014 Beaver Fire. **Not Properly Functioning**.

Also refer to the following 7th field checklists for more detailed info. on conditions in this watershed:

Lower Horse Creek HUC14 environmental baseline summary table

Middle Horse Creek HUC14 environmental baseline summary table

CHECKLIST FOR DOCUMENTING ENVIRONMENTAL BASELINE AND EFFECTS

OF PROPOSED ACTION(S) ON RELEVANT INDICATORS

PROJECT: **Westside Fire Recovery**
WATERSHED: **North Fork Salmon River**

DIAGNOSTIC OR PATHWAY and INDICATOR	Environmental Baseline			Effects of the Action		
	PROPERLY FUNCTIONING	**FUNCTIONING - AT RISK**	**NOT PROP. FUNCT.**	**RESTORE**	**MAINTAIN**	**DEGRADE**
HABITAT:						
Habitat Quality Temperature		Coho 2014; SRCA 1998; WA 1995			X	
Suspended Sediment - Intergravel DO/Turbidity	CWE 2015; WA 1995				X	
Chemical Contamination/ Nutrients	CA-EPA				X	
Habitat Access Physical Barriers	CDFW 2015; Coho 2014; Siskiyou 2002; FishPass 2001				X	
Habitat Elements Substrate Character and Embeddedness		SRCA 1998; WA 1995			X	
Large Woody Debris			Coho 2014; SRCA 1998; WA 1995		X	
Pool Frequency and Quality		SRCA 1998; WA 1995			X	
Large Pools					X	
Off-channel Habitat		PJ; Coho 2014			X	
Refugia	PJ				X	
Channel Cond & Dyn Average Wetted Width/Maximum Depth	PJ; CWE 2015				X	
Streambank Condition	ND - likely Properly Functioning (PJ)				X	
Floodplain Connectivity	PJ, Coho 2014				X	
Flow/Hydrology Change in Peak/Base Flows	PJ; CWE 2015; Coho 2014				X	
Increase in Drainage Network	PJ; CWE 2015				X	

DIAGNOSTIC OR	Environmental Baseline			Effects of the Action		
Watershed Conditions Road Density & Location	CWE 2015; SRSS 2002				X	
Disturbance History & Regime	PJ; CWE 2015; WA 1995				X	
Riparian Reserves - Northwest Forest Plan		PJ; Coho 2014; WA 1995			X	
SPECIES AND HABITAT:						
Species and Habitat: Summary/Integration of all Species and Habitat Indicators		X			X	
	For the Salmon River drainage, long-term trends for most anadromous species/runs are unclear (Quiñones 2011). The exceptions include spring Chinook (increasing) and summer steelhead (decreasing), but these trends also show a signal of hatchery influence (Quiñones 2011). See Life History section for additional information.			See Env. Conseq. for a Indicator effects summary. The Env. Conseq. section also describes effects to fish and their habitat.		

References:

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Quiñones, R.M. 2011. Recovery of Pacific salmonids (*Oncorhynchus* spp.) in the face of climate change: a case study of the Klamath River Basin, California. PhD Thesis. University of California, Davis, California. 129 p.

Taylor, R., M. Love, T. Grey, and A Knoche. 2002. Final report: Siskiyou County culvert inventory and fish passage evaluation. Report to the Five Counties Salmonid Conservation Program (Contract #P9985047).

Available online: http://www.5counties.org/docs/migbar_invrpt_sis.pdf

USDA Forest Service (USFS). 2013. Stream sediment monitoring on the Klamath National Forest, 2009-2012. Klamath National Forest, Yreka, CA. 18 pp.

_____. 2012. Draft stream temperature monitoring on the Klamath National Forest, 2010 to 2011. Klamath National Forest, Yreka, CA. 17 p.

_____. 1998. Salmon River and Dillon Creek watersheds fish habitat and channel type analysis. Prepared for the Klamath National Forest by EA Engineering, Science, and Technology, Sacramento, CA. 31 pp + appendices.

_____. 1995. North Fork watershed analysis. Salmon River and Scott River Ranger Districts, Klamath National Forest, Yreka, CA.

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Note on temperatures:
Greg's report has N. Russian, S. Russian, and Whites (barely) above the 16 C MWMT beneficial uses water temperature, but raw hobo temps all well below AP condition for Properly Functioning

CHECKLIST FOR DOCUMENTING ENVIRONMENTAL BASELINE AND EFFECTS OF PROPOSED ACTION(S) ON RELEVANT INDICATORS
PROJECT: **Westside Fire Recovery**
WATERSHED: **Seiad Creek-Klamath River**

Pathways: INDICATORS	ENVIRONMENTAL BASELINE Seiad Creek-Klamath River HUC10 *			EFFECTS OF THE ACTION(S) Seiad Creek-Klamath River HUC10 *		
	Properly Functioning	**At Risk**	**Not Properly Functioni**	**Restore**	**Maintain**	**Degrade**
Water Quality Temperature			TEMP TMDL		X	
Sediment – Turbidity			ND/PO/ PJ		X	
Chemical/Nutrient Contamination			TMDL		X	
Habitat Access Physical Barrier	FPI/PO				X	
Habitat Elements Substrate Character		TMDL ND/PO/ PJ			X	
Large Woody Debris			ND/PO/ PJ		X	
Pool Frequency/Quality		ND/PO/ PJ			X	
Off-Channel Habitat			PO/PJ		X	
Refugia		TMDL PO/PJ			X	
Channel Cond & Dyn Width-to-Depth Ratio		ND/PO/ PJ			X	
Streambank Condition		ND/PO/ PJ			X	
Floodplain Condition			PO/PJ		X	
Flow /Hydrology Change in Peak/Base Flow			TMDL RSS PO/PJ		X	
Drainage Network Increase		KNF GIS RSS			X	
Watershed Cond. Road Density/Location		PO/PJ			X	
Disturbance History/Regime		KNF GIS PO/PJ			X	
Riparian Reserves			KNF GIS		X	

TEMP = Water temperature monitoring of mainstem Klamath River upstream of Grider Creek; **TMDL =** These indicators are impaired according to USEPA Clean Water Act Section 303(D) for exceeding allowable Total Maximum Daily Loads (TMDLs) of pollutants – SEE Klamath RIVER TMDL; **ND** = No Data; **NA** = Not Applicable; **PO** = Personal Observation; **PJ** = Professional Judgment; **FPI** = KNF Forest-Wide Fish Passage Barrier Inventory; **RSS** = Road Sediment Source surveys (KNF 1999-2013); **KNF GIS** = KNF GIS database query and CWE modeling for WFR Project (Fall 2014 to Winter 2015);

Environmental Baseline completed by Jon Grunbaum on April 15, 2015.

* = This environmental baseline describes the watershed condition of the Seiad Creek-Klamath River HUC10. Specifically, this environmental baseline describes the condition of aquatic habitat and water quality in the Klamath River and watershed conditions throughout the HUC10. Appendices to this environmental baseline are HUC14 environmental baseline summary tables that summarize the condition of aquatic habitat and watershed in the tributaries that support salmon (that were affected by the 2014 Fires). These HUC14s are: Lower Grider Creek; Upper Grider Creek; Lower Seiad Creek; O'Neil Creek; and Tom Martin Creek (completed descriptive versions of these HUC14 environmental baselines are available in the project record). All of the Grider Creek HUC14 environmental baselines were included because this is an important watershed for salmon and steelhead and because so much of this watershed burned at moderate to high severity (therefore, the Cliff Valley Creek HUC14 and the Rancheria Creek HUC14 environmental baselines are included in the appendices).

Seiad Creek-Klamath River Environmental Baseline Elements:

Water Quality

Water Temperature: The mainstem Klamath River exceeds the water temperature TMDL (CA State Water Board, 2010). Summer water temperature of the mainstem Klamath River was monitored from 2011 to 2014 just upstream of the confluence of Grider Creek (which is about three miles upstream of the downstream drain of the Seiad Creek-Klamath River HUC10). In the four year period of record the maximum instantaneous water temperature ranged from 24.5^{o}C to 27.8^{o}C; the maximum weekly average temperature (MWAT) ranged from 22.9^{o}C to 25.7^{o}C; and the maximum weekly maximum temperature ranged from 24.2^{o}C to 27.0^{o}C. **Not Properly Functioning**.

Recent Water Temperature Monitoring Results for Mainstem Klamath River Upstream of Grider Creek Confluence

Start	End	Max Daily Max Temp C	Max Average Daily Temp C	Max Diurnal Variation Temp C	Maximum Weekly Average Temp C (MWAT)	Maximum Weekly Maximum Temp C (MWMT)
7/7/2011	8/14/2011	24.5	23.3	3.5	22.9	24.2
6/14/2012	10/23/2012	25.6	24.5	3.8	24.0	25.1
6/11/2013	10/16/2013	27.2	25.8	3.6	25.2	26.4
5/29/2014	10/6/2014	27.8	26.3	3.9	25.7	27.0

Sediment - Turbidity: Even before the 2014 Beaver Fire and Happy Camp Complex Fire the mid-Klamath River would become quite turbid during moderate to heavy precipitation and runoff events and remain turbid for long periods thereafter. However, the magnitude and duration of turbidity had actually been decreasing over the 20 years preceding the 2014 Fires (personal observation). Much of the pre-2014 Fires turbidity was due to high levels of disturbance from an era of intense logging and road construction (1955 – 1995) in the Seiad Creek-Klamath River HUC10 and in many areas within the HUC10s upstream of the Seiad Creek-Klamath River HUC10. The 1987 Fires also likely contributed to the turbidity. HUC10s upstream of Iron Gate Dam contribute very little sediment or turbidity to the mainstem Klamath River because the deep volcanic soils do not facilitate much overland flow and because the dam acts as a settling basin.

Many thousands of acres within the Seiad Creek-Klamath River HUC10 burned at moderate to high intensity in the 2014 Happy Camp Complex Fire. Additionally, many thousands of acres of forest that drain into the reach of the mid-Klamath River that flows through the Seiad Creek-Klamath River HUC10 burned at moderate to high severity in the 2014 Beaver and Happy Camp Complex Fires. The 2014 Fires have already greatly increased the rate of sediment delivery into streams and increased the magnitude and duration of turbidity events. The frequency, magnitude and duration of 2014 Fires-related turbidity is likely to be significantly elevated for at least the next few years until vegetation gets re-established and ground cover increases, and excess fines are winnowed out of the system. Risk of landslides that can cause bouts of acute turbidity will likely be increased for a decade or more due to decreased evapotranspiration, decreased ground cover, increased groundwater, increased overland flow, and/or loss of soil cohesion provided by living tree roots. Modeled surface erosion risk (USLE = 0.68) is moderately elevated and modeled mass wasting risk (GEO = 0.82) is highly elevated in the Seiad Creek-Klamath River HUC10. Modeled surface erosion risk and mass wasting risk are high to over-threshold in many of the HUC10s upstream of the Seiad Creek-Klamath River HUC10. **Not Properly Functioning**

Chemical/Nutrient Contamination: The Klamath River mainstem is listed under the US-EPA Section 303(d) of the Clean Water Act as exceeding TMDL for water temperature, nutrients, and organic enrichment/low dissolved oxygen. Industrial and municipal point sources, agricultural runoff, water impoundment, flow regulation and modification, and natural and non-point sources are implicated for the high nutrient and organic enrichment loads, and low dissolved oxygen concentration. Chemical contamination (from fertilizers, pesticides, pharmaceuticals, heavy metals, solvents, etc.) can reasonably be expected to accompany agricultural return flows, and municipal and industrial point sources. Most organic enrichment of the mid-Klamath River occurs upstream of the Seiad Creek-Klamath River HUC10 (in the upper Klamath, Scott, and Shasta River basins). The mainstem Klamath River has its origins in the naturally warm shallow eutrophic Upper Klamath Lake that is rich in nutrients and organic matter. However, considerably more nutrient and organic matter is delivered to the mainstem in tailwater from grazing and agriculture occurring throughout the upper Klamath, Scott, and Shasta River basins, and from urban effluent. Excess nutrients and water impoundment of the Klamath River is suspected of causing intense blooms of a toxic blue-green algae (cyanobacteria) in Iron Gate Reservoir and other impoundments upstream of Iron gate Reservoir. Toxic algae (or toxin from burst cyanobacteria) from these impoundments has been entrained throughout the entire length of the mid- and lower mid-Klamath River nearly every summer since 2005. Mid-Klamath tributaries (with the exception of the Scott and Shasta Rivers) including those in the Seaid Creek-Klamath River HUC10 generally contribute relatively nutrient-poor chemical contamination-free water to the river. **Not Properly Functioning**.

Habitat Access

Physical Barriers: There are no known human-caused barriers to fish passage within the Seaid Creek-Klamath River HUC10. **Properly Functioning.**

Habitat Elements

Substrate Character: Even before the 2014 Beaver and Happy Camp Complex Fires many Klamath River tributary drainages in the Seaid Creek-Klamath River HUC10 and in upstream HUC10s had elevated erosion and sedimentation rates, and moderate to high modeled Cumulative Watershed Effects (**CWEs**), primarily due to roads, past timber harvest, and mining on all-lands, and to clearing and development on private land. Many thousands of acres of forest that drain into the reach of the mid-Klamath River that flows through the Seaid Creek-Klamath River HUC10 burned at moderate to high severity in the 2014 Beaver and Happy Camp Complex Fires. The 2014 Fires have already greatly increased the rate of sediment delivery into streams and the Klamath River (personal observation). The frequency, magnitude and duration of chronic elevated sediment delivery from surface erosion from the 2014 Fires is likely to be remain elevated for at least the next few years until vegetation gets re-established and ground cover increases, and excess fines are winnowed out of the system. The risk of acute bouts of elevated sediment delivery from mass wasting resulting from the 2014 Fire will be increased for a decade or more due to decreased evapotranspiration, decreased ground cover, increased groundwater, increased overland flow, and/or loss of soil cohesion provided by living tree roots. Modeled surface erosion risk (USLE = 0.68) and mass wasting risk (GEO = 0.82) are high in the Seiad Creek-Klamath River HUC10. Modeled surface erosion risk and mass wasting risk are highly elevated to over threshold in many of the HUC10s upstream of the Seiad Creek-Klamath River HUC10.

Sediment character and regime in the Klamath River is also adversely affected by water diversions and hydropower operations (dams) up-river which: (1) adversely affects sediment transport processes in the river below the diversions and dams by decreasing stream flow and the river's ability to move sediment and to self-cleanse and (2) adversely affects sediment transport processes by preventing sediment delivery from the upper basin (above Iron Gate Dam) to the lower basin. **At-Risk**

Large Woody Debris: Because the channel of the mainstem Klamath River is so wide, even whole trees with rootwads attached often do not remain in the channel for long periods before being transported downstream by high flows, however, current levels of LWD in the mainstem Klamath River are likely considerably reduced from pre-settlement levels. Most of the type of LWD that does tend to have long in-channel residence time results from large streamside conifers that fall over into the stream with the rootwad still attached and rootwad still on the streambank or hillslope. The capacity to grow large streamside conifers and the potential for future LWD recruitment to the river has been significantly reduced within the Seiad Creek-Klamath River HUC10 because trees within or adjacent to the stream buffer RR are readily accessible to the public (permitted or not) and agencies via the Klamath River Highway that closely parallels much of the mainstem length, via Grider Creek Road that parallels the Klamath River between Walker Creek and Grider Creek, via Ladd Road, via river accesses, and via riverfront private properties. Road construction and maintenance (including hazard tree removal) in stream buffers prevents large trees from growing and removes large trees that might have become LWD. On many of the streamside private properties, current land use practices removes large trees that could recruit to the river and/or precludes the growth of large trees. There is a large area of dredge tailings north of the river in the Seiad Valley that does not support the growth of large streamside trees. Compared to pre-

settlement conditions, there are fewer and/or smaller logs being delivered to the mainstem from tributary watersheds because of road construction and maintenance within stream buffer, past clearcut logging within stream buffers, and clearing and/or development on private land within stream buffers.

N**ot Properly Functioning**.

Pool Frequency and Quality: Reduction of mainstem pool depth and volume due to infilling is likely occurring because: (1) excessive sediment has been delivered to the mainstem from numerous areas of high watershed disturbance upstream in the mid-Klamath sub-basin and the Scott River watershed and (2) reduced magnitude and duration of flow in the mainstem (due to upstream water management and hydropower operations) has reduced sediment transport capability. Pool quality may be reduced because of lack of LWD. **At-Risk**.

Off-channel Habitat: The constrained channel types characteristic of much of the mid-Klamath River generally do not have broad floodplains and do not allow much development of off-channel habitat. The only major unconstrained reach of the mainstem in the Seiad Creek-Klamath River HUC10 is north of the river in Seiad Valley but the entire floodplain was industrially dredged in the mid-1900s and the dredge tailings are still there preventing the river from interacting with its historical floodplain and from developing off-channel habitat. Access to other mainstem floodplain/off-channel habitat areas is adversely affected by altered flow regime from upstream water diversions and hydropower operations. Decreased flows from up-river have decreased hydrologic connectivity between the river and off-channel habitats/floodplains, have reduced the size and temporal duration of these habitats, and have decreased ease of access to and from these critical rearing areas by juvenile salmon and steelhead. Lower Seiad Creek and lower Grider Creek are the only other major unconstrained stream reaches in the HUC10. Lower Seiad Creek has been constrained by berms that were pushed with bulldozers up after major floods in attempts to re-constrain the stream. The berms on lower Grider Creek are minor and constrain only small reaches of stream. **Not Properly Functioning**

Refugia: This section of the Klamath River provides spawning, rearing, and migration habitats for salmon, steelhead trout, and other anadromous and resident fish species. Poor water quality in the mainstem Klamath River has been physically documented through monitoring (as is described in the Environmental Baselines in the Indicator analyses for Water Temperature, Turbidity, Substrate, and Chemical Contamination) and biologically evidenced by frequent fish kills and high incidence of disease and mortality. Water temperatures in the Klamath River mainstem reach critically high levels for salmonids in summer and salmonids must find cooler water on hot days or during hot periods in order to survive. Klamath River summer thermal refugia is associated with tributaries having cool clear water. Cool, clear, un-polluted water from (most) mid-Klamath River tributaries function to maintain or improve water quality in the mid-Klamath River in summer. Unfortunately, flow and water quality from some of the tributaries is diminished in summer due to water diversion. The 2014 Happy Camp Complex Fire is likely to result in further diminishment of thermal refugia by increasing water temperatures in tributaries where large swaths of riparian vegetation burned at moderate to high intensity. Winter refugia from high water has been eliminated or degraded by past industrial dredging and berming (see Off-Channel Habitat indicator discussion). **At-Risk**.

Width-to-Depth Ratio: Reduction of mainstem pool depth and volume due to infilling is likely occurring because: (1) excessive sediment has been delivered to the mainstem from numerous areas of high watershed disturbance upstream in the mid-Klamath sub-basin and the Scott River watershed and (2) reduced magnitude and duration of flow in the mainstem (due to upstream water management and hydropower operations) has reduced sediment transport capability. Historical industrial dredging has altered a major reach of channel in the Seiad Valley transforming it from an unconstrained to a constrained channel. The channel of lower Seiad Creek has been constrained by berming. **At-Risk**.

Streambank Condition: There are roads in the riparian buffer on both sides of the river for over half its length within the Seiad Creek-Klamath River HUC10. Some of the road sections are directly adjacent to the river or within inner gorge so that the road fill or revetment composes the "streambanks". Dredge tailings compose the streambank in a long reach in the Seaid Valley. Historic large-scale industrial dredging has overturned the streambed and streambanks in several locations leaving large piles of dredge tailings as "streambanks" that will not support vegetation. The "streambank" of lower Seaid Creek is a series of berms. There is high density of roads in stream buffer RRs and high density of stream crossings in many of the tributary watersheds. Hundreds of acres of riparian vegetation in hydrologic RRs burned at moderate to high severity in the 2014 Happy Camp Complex Fire. **At-Risk**.

Floodplain Connectivity: See discussion for Off-Channel Habitat indicator above. **Not Properly Functioning.**

Flow/Hydrology

Change in Peak/Base Flow: The flow regime in the mid-Klamath River is altered by numerous water diversions and a major hydropower operation (PacifiCorps) that are upstream from the Seiad Creek-Klamath River HUC10. However, there are also numerous water diversions from tributaries within the Seiad Creek –Klamath River HUC10. Adverse changes in river flow regime have resulted in less water in spring/summer when juvenile anadromous salmonids need good flow and water quality to migrate to the ocean and/or to access off-channel habitats. Modeled runoff risk for the entire HUC10 is moderately elevated (ERA/TOC = 0.55). The flow regime in the mid-Klamath River is Not Properly Functioning because of significant water diversion and flow regulation by dams. Peak flows in some of the Klamath River tributaries are elevated from roads, past timber harvest, past wildfires, and other ground disturbances. The flow regime in some of the tributaries is not properly functioning because of excessive water diversion (particularly Seiad Creek that is officially "over-allocated") in summer and increased peak flows in winter**.** The 2014 Happy Camp Complex Fire is expected to increase peak flows in tributaries in the where large swaths of forest burned at moderate to high intensity. **Not Properly Functioning**

Drainage Network Increase: The Klamath River corridor has moderate to high road density, many miles of valley bottom and inner gorge road, and low to moderate level of ground disturbance and compaction from private and public development. Some of the tributary watersheds have moderate to high road densities. There is some potential for drainage network increase due to roads because percent hydrologically-connected road ranges from 0% to 25% (median = 7%) in the HUC14 watersheds. **At-Risk**

Watershed Conditions

Road Density/Location: Some of the tributary watersheds within the Seiad Creek-Klamath River HUC10 have moderate to high road densities. The valley-bottom Klamath River Highway closely parallels the river for much of its' length in the HUC10 and other miles of streamside roads run along the opposite bank (particularly Grider Road between Walker Creek and Grider Creek; Ladd Road between Seiad and Negro Creek). There are miles of valley-bottom/inner gorge road in the tributaries as well, particularly in the Seaid and Walker Creek watersheds. There are numerous private roads in stream buffers and river accesses throughout the HUC10. **At-Risk**

Disturbance History/Regime: Some of the HUC14 watersheds in the Seiad Creek-Klamath River HUC10 have moderate to high CWEs due primarily to roads, past timber harvest, wildfires, and/or historic large-scale mining. There is moderate to high road density within the river corridor in some of the tributaries, and many miles of valley-bottom and inner gorge road throughout the HUC10. There are numerous localized areas of disturbance in the stream buffer associated with stream crossings and vehicular river accesses, plus private and unauthorized roads. The lower Seiad Creek and valley was overturned during industrial dredging in the mid-1900s and has a long ways to go to recovery. The mid- Klamath River corridor has been impacted in places by historic large-scale hydraulic mining operations that have left lasting imprints on lower slopes adjacent to the river and large mounds of dredge tailings in the stream channel and stream buffer. The 2014 Happy Camp Complex Fire burned thousands of acres at moderate to high severity - nearly the entire HUC10 on the south side of the river burned. Modeled watershed disturbance is moderately to highly elevated due to roads, the 2014 Fire, vegetation management, and firelines – in that order: surface erosion risk (USLE = 0.68); mass wasting risk (GEO = 0.82); and runoff risk (ERA/TOC = 0.55). **At-Risk.**

Riparian Reserves: There are roads in the riparian buffer on both sides of the river. There is high density of roads in RR and stream crossings in many of the tributary watersheds. Much of the land adjacent to the Klamath River and lower Seiad Creek is private and has had riparian vegetation cleared or greatly reduced, and wetlands converted, to enable grazing, farming, or other uses. Noxious weed species have invaded the river bars. Historic large-scale industrial dredging has overturned the streambed in many locations leaving large piles of dredge tailings that will not support vegetation and that blocks the rivers interaction with its floodplain - resulting in significant diminishment of off-main-channel aquatic habitats. Lower Seiad Creek valley was overturned in industrial dredging operations in the mid-1900s and is still far from recovery. Subsequently, berms that were pushed up to "contain" lower Seiad Creek after floods prevent the stream from interacting with its floodplain and has resulted in severe degradation and aggradation of the channel. The floodplain of the largest (historically) unconstrained reach of the river (in this HUC10) was industrially dredged and the mountains of tailings are still there preventing the river from interacting with its floodplain. Hundreds of acres of vegetation in hydrologic RRs and geologic RRs burned at moderate to high severity in the in the 2014 Beaver Fire. **Not Properly Functioning**.

Refer to the following 7th field matrices for more detailed information on this watershed:

- Cliff Valley Creek HUC14 environmental baseline summary table
- Lower Grider Creek HUC14 environmental baseline summary table

- Lower Seiad Creek HUC14 environmental baseline summary table
- O'Neil Creek HUC14 environmental baseline summary table
- Rancheria Creek HUC14 environmental baseline summary table
- Tom Martin Creek HUC14 environmental baseline summary table
- Upper Grider Creek HUC14 environmental baseline summary table
- Walker Creek HUC14 environmental baseline summary table

CHECKLIST FOR DOCUMENTING ENVIRONMENTAL BASELINE AND EFFECTS

OF PROPOSED ACTION(S) ON RELEVANT INDICATORS

PROJECT: **Westside Fire Recovery**

WATERSHED: South Fork Salmon River

DIAGNOSTIC OR PATHWAY and INDICATOR	Environmental Baseline			Effects of the Action		
	PROPERLY FUNCTIONING	FUNCTIONING - AT RISK	NOT PROP. FUNCT.	RESTORE	MAINTAIN	DEGRADE
HABITAT:						
Habitat Quality Temperature[1]			Coho-Sal 2014; SRCA 1998; WA 1997, 1994		X	
Suspended Sediment - Intergravel DO/Turbidity	CWE 2015; WA 1997, 1994				X	
Chemical Contamination/ Nutrients	CA-EPA				X	
Habitat Access Physical Barriers	CDFW 2015; Coho-Sal 2014; Siskiyou 2002; FishPass 2001[2]				X	
Habitat Elements Substrate Character and Embeddedness		SRCA 1998; WA 1997, 1994			X	
Large Woody Debris			Coho-Sal 2014; SRCA 1998; WA 1997, 1994		X	
Pool Frequency and Quality		SRCA 1998; WA 1997, 1994			X	
Large Pools					X	
Off-channel Habitat		PJ; Coho-Sal 2014			X	
Refugia	PJ				X	

DIAGNOSTIC OR	Environmental Baseline			Effects of the Action		
Channel Cond & Dyn Average Wetted Width/Maximum Depth	PJ; CWE 2015				X	
Streambank Condition	ND - likely Properly Functioning (PJ)				X	
Floodplain Connectivity	PJ, Coho-Sal 2014				X	
Flow/Hydrology Change in Peak/Base Flows	PJ; CWE 2015; Coho-Sal 2014				X	
Increase in Drainage Network	PJ; CWE 2015				X	
Watershed Conditions Road Density & Location	CWE 2015; SRSS 2002				X	
Disturbance History & Regime		PJ; Coho-Sal 2014; WA 1997, 1994			X	
Riparian Reserves - Northwest Forest Plan		PJ; Coho-Sal 2014; WA 1997, 1994			X	
SPECIES AND HABITAT:						
Species and Habitat: Summary/Integration of all Species and Habitat Indicators		X			X	
	For the Salmon River drainage, long-term trends for most anadromous species/runs are unclear (Quiñones 2011). The exceptions include spring Chinook (increasing) and summer steelhead (decreasing), but these trends also show a signal of hatchery influence (Quiñones 2011). See Life History section for additional information.			See Env. Conseq. for a Indicator effects summary. The Env. Conseq. section also describes effects to fish and their habitat.		
[1]Mainstem temperatures considered to be Not Properly Functioning. EF Salmon River, the largest tributary, is Functioning-At-Risk; and smaller tributaries generally Functioning Properly. [2]Barriers within range of anadromy in EF Salmon River have been remediated or are scheduled for remediation.						

CHECKLIST FOR DOCUMENTING ENVIRONMENTAL BASELINE AND EFFECTS

OF PROPOSED ACTION(S) ON RELEVANT INDICATORS

PROJECT: **Westside Fire Recovery**

WATERSHED: **Lower Scott River**

DIAGNOSTIC OR PATHWAY and INDICATOR	Environmental Baseline			Effects of the Action		
	PROPERLY FUNCTIONING	**FUNCTIONING - AT RISK**	**NOT PROP. FUNCT.**	**RESTORE**	**MAINTAIN**	**DEGRADE**
HABITAT:						
Habitat Quality Temperature			Temps-Scott		X	
Suspended Sediment - Intergravel DO/Turbidity		PJ			X	
Chemical Contamination/ Nutrients			CA-EPA		X	
Habitat Access Physical Barriers	CDFW 2015; Coho-Sct 2014				X	

DIAGNOSTIC OR	Environmental Baseline			Effects of the Action		
Habitat Elements Substrate Character and Embeddedness			PJ[1,2]; Coho-Sct 2014		X	
Large Woody Debris			Coho-Sct 2014; WA 2000		X	
Pool Frequency and Quality	ND - likely altered due to historic mining practices				X	
Large Pools					X	
Off-channel Habitat		PJ[1]; Coho-Sct 2014			X	
Refugia		PJ[1]			X	
Channel Cond & Dyn Average Wetted Width/Maximum Depth	ND - likely altered due to historic mining practices				X	
Streambank Condition			PJ[1,2]		X	
Floodplain Connectivity		PJ[1]; Coho-Sct 2014			X	
Flow/Hydrology Change in Peak/Base Flows			PJ[1]; Coho-Sct 2014		X	
Increase in Drainage Network		PJ[1]			X	
Watershed Conditions Road Density & Location		WA 2000			X	
Disturbance History & Regime		PJ[1]; Coho-Sct 2014; WA 2000			X	
Riparian Reserves - Northwest Forest Plan		PJ; Coho-Sct 2014; WA 2000			X	
SPECIES AND HABITAT:						
Species and Habitat: Summary/Integration of all Species and Habitat Indicators		X			X	
	Due to lack of data, specific trend for anadromous fish in this drainage is unknown. However, some sources are available to examine the general Scott River condition. (1) Screw trap data since 2000 suggests a steady to upward trend for Chinook smolts and steady to slightly down for steelhead smolts (CDFW 2011). (2) Run size estimate for spawning Chinook since 1978 is steady to slightly down (CDFW 2013). Recent trends for coho are unclear, but overall the run is considered to be depressed. See Life History section for additional information			See Env. Conseq. for a Indicator effects summary. The Env. Conseq. section also describes effects to fish and their habitat.		

[1]This 5th-field watershed includes extensive private property within/without the Forest boundary. Historic resource use throughout the drainage, including dredging, has impacted the watershed, and agriculture and timber extraction continue on private. Therefore, while Forest Service, or inholdings within the boundary, may show properly functioning condition - for instance, all CWE models under "1" threshold (CWE 2015) - the consideration of the *whole* 5th-field watershed suggest lower ratings. Data is largely lacking for private properties.
[2]Due to size of lower Scott River and extreme difficulty to survey, comprehensive datasets for physical attributes are not available.

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CHECKLIST FOR DOCUMENTING ENVIRONMENTAL BASELINE AND EFFECTS OF PROPOSED ACTION(S) ON RELEVANT INDICATORS
PROJECT: **Westside Fire Recovery**
WATERSHED: **Thompson Creek-Klamath River**

Pathways: INDICATORS	ENVIRONMENTAL BASELINE Thompson Creek-Klamath River (HUC10) Watershed *			EFFECTS OF THE ACTION(S) Thompson Creek-Klamath River (HUC10) Watershed *		
	Properly Functioning	**At Risk**	**Not Properly Functioni**	**Restore**	**Maintain**	**Degrade**
Water Quality Temperature			TEMP TMDL		X	
Sediment – Turbidity			ND/PO/ PJ		X	
Chemical/Nutrient Contamination			TMDL		X	
Habitat Access Physical Barrier	FPI/PO				X	
Habitat Elements Substrate Character		TMDL ND/PO/ PJ			X	
Large Woody Debris			ND/PO/ PJ		X	
Pool Frequency/Quality		ND/PO/ PJ			X	
Off-Channel Habitat		PO/PJ			X	
Refugia		TMDL PO/PJ			X	
Channel Cond & Dyn Width-to-Depth Ratio		ND/PO/ PJ			X	
Streambank Condition		KNF GIS			X	
Floodplain Condition	PO/PJ				X	
Flow /Hydrology Change in Peak/Base Flow			KNF GIS RSS PO/PJ		X	
Drainage Network Increase		KNF GIS PO/PJ			X	
Watershed Cond. Road Density/Location		KNF GIS PO/PJ			X	
Disturbance History/Regime		KNF GIS PO/PJ			X	
Riparian Reserves		KNF GIS			X	

TEMP = Water temperature monitoring of mainstem Klamath River upstream of Indian Creek (at downstream drain of Thompson Creek-Klamath River HUC10); **TMDL =** These indicators are impaired according to USEPA Clean Water Act Section 303(D) for exceeding allowable Total Maximum Daily Loads (TMDLs) of pollutants – SEE Klamath RIVER TMDL; **ND** = No Data; **NA** = Not Applicable; **PO** = Personal Observation; **PJ** = Professional Judgment; **FPI** =

KNF Forest-Wide Fish Passage Barrier Inventory; **RSS** = Road Sediment Source surveys (KNF 1999-2013); **KNF GIS** = KNF GIS database query and CWE modeling for WFR Project (Fall 2014 to Winter 2015);
Environmental Baseline completed by Jon Grunbaum on April 15, 2015.

* = This environmental baseline describes the watershed condition of the Thompson Creek-Klamath River HUC10. Specifically, this environmental baseline describes the condition of aquatic habitat and water quality in the Klamath River and watershed conditions throughout the HUC10. Appendices to this environmental baseline are HUC14 environmental baseline summary tables that summarize the condition of aquatic habitat and watershed in the tributaries that support salmon or steelhead: These HUC14s are: China Creek, Fort Goff Creek, Horse Creek, and Portuguese Creek.

Thompson Creek-Klamath River 5th-Field (HUC10) Environmental Baseline Elements:

Water Quality

Water Temperature: The mainstem Klamath River exceeds the water temperature TMDL (CA State Water Board, 2010). Summer water temperature of the mainstem Klamath River was monitored from 2011 to 2014 just upstream of the confluence of Indian Creek (this monitoring site is at the downstream drain of the Thompson Creek-Klamath River HUC10). In the four year period of record the maximum instantaneous water temperature ranged from 25.6°C to 28.7°C; the maximum weekly average temperature (MWAT) ranged from 23.5°C to 26.3°C; and the maximum weekly maximum temperature ranged from 25.2°C to 28.2°C. **Not Properly Functioning**.

Recent Water Temperature Monitoring Results for Mainstem Klamath River Upstream of Indian Creek Confluence						
Start	**End**	**Max Daily Max Temp C**	**Max Average Daily Temp C**	**Max Diurnal Variation Temp C**	**Maximum Weekly Average Temp C (MWAT)**	**Maximum Weekly Maximum Temp C (MWMT)**
7/6/2011	10/3/2011	25.6	23.9	3.3	23.5	25.2
6/22/2012	10/23/2012	26.7	25.0	3.5	24.5	26.2
6/10/2013	9/30/2013	28.7	26.7	3.8	25.8	27.6
5/28/2014	9/30/2014	28.7	26.7	3.6	26.3	28.2

Sediment - Turbidity: Even before the 2014 Beaver Fire and Happy Camp Complex Fire the mid-Klamath River would become quite turbid during moderate to heavy precipitation and runoff events and remain turbid for long periods thereafter. However, the magnitude and duration of turbidity had actually been decreasing over the 20 years preceding the 2014 Fires (personal observation). Much of the pre-2014 Fires turbidity was due to high levels of disturbance from an era of intense logging and road construction (1955 – 1995) in the Thompson Creek-Klamath River HUC10 and in many upstream HUC10s. The 1987 Fires also likely contributed to the turbidity. HUC10s upstream of Iron Gate Dam contribute very little sediment or turbidity to the mainstem Klamath River because the deep volcanic soils do not facilitate much overland flow and because the dam acts as a settling basin.

A couple thousand acres within the Thompson Creek-Klamath River HUC10 burned at moderate to high intensity in the 2014 Happy Camp Complex Fire. Additionally, many thousands of acres of forest that drain into the reach of the mid-Klamath River that flows through the Thompson Creek-Klamath River HUC10 burned at moderate to high severity in the 2014 Beaver and Happy Camp Complex Fires. The 2014 Fires have already greatly increased the rate of sediment delivery into streams and increased the magnitude and duration of turbidity events. The frequency, magnitude and duration of 2014 Fires-related turbidity is likely to be significantly elevated for at least the next few years until vegetation gets re-established and ground cover increases, and excess fines are winnowed out of the system. Risk of landslides that can cause bouts of acute turbidity will likely be increased for a decade or more due to decreased evapotranspiration, decreased ground cover, increased groundwater, increased overland flow, and/or loss of soil

cohesion provided by living tree roots. The 2014 Happy Camp Complex burned the portion of HUC10 that is south of the Klamath River. Much of the portion of the HUC10 that is north of the river burned in the 2012 Goff Fire, however, that fire burned at mostly low intensity. Modeled surface erosion risk (USLE = 0.29) is slightly elevated and modeled mass wasting risk (GEO = 0.49) is moderately elevated in the Thompson Creek-Klamath River HUC10. Modeled surface erosion risk and mass wasting risk is moderate to high to over-threshold in many of the HUC10s upstream of the Thompson Creek-Klamath River HUC10. The sediment-turbidity indicator is **Not Properly Functioning** primarily because of watershed disturbance upstream of the Thompson Creek-Klamath River HUC10.

Chemical/Nutrient Contamination: The Klamath River mainstem is listed under the US-EPA Section 303(d) of the Clean Water Act as exceeding TMDL for water temperature, nutrients, and organic enrichment/low dissolved oxygen. Industrial and municipal point sources, agricultural runoff, water impoundment, flow regulation and modification, and natural and non-point sources are implicated for the high nutrient and organic enrichment loads, and low dissolved oxygen concentration. Chemical contamination (from fertilizers, pesticides, pharmaceuticals, heavy metals, solvents, etc.) can reasonably be expected to accompany agricultural return flows, and municipal and industrial point sources. Most organic enrichment of the mid-Klamath River occurs upstream of the Thompson Creek-Klamath River HUC10 (in the upper Klamath, Scott, and Shasta River basins). The mainstem Klamath River has its origins in the naturally warm shallow eutrophic Upper Klamath Lake that is rich in nutrients and organic matter. However, considerably more nutrient and organic matter is delivered to the mainstem in tailwater from grazing and agriculture occurring throughout the upper Klamath, Scott, and Shasta River basins, and from urban effluent. Excess nutrients and water impoundment of the Klamath River is suspected of causing intense blooms of a toxic blue-green algae (cyanobacteria) in Iron Gate Reservoir and other impoundments upstream of Iron gate Reservoir. Toxic algae (or toxin from burst cyanobacteria) from these impoundments has been entrained throughout the entire length of the mid- and lower mid-Klamath River nearly every summer since 2005. Mid-Klamath tributaries (with the exception of the Scott and Shasta Rivers) including those in the Thompson Creek-Klamath River HUC10 generally contribute relatively nutrient-poor chemical contamination-free water to the river. **Not Properly Functioning**.

Habitat Access

Physical Barriers: There are no known human-caused barriers to fish passage within the Thompson Creek-Klamath River HUC10. **Properly Functioning.**

Habitat Elements

Substrate Character: Even before the 2014 Happy Camp Complex Fires many Klamath River tributary drainages in the Thompson Creek-Klamath River HUC10 and in upstream HUC10s had elevated erosion and sedimentation rates, and moderate to high modeled Cumulative Watershed Effects (**CWEs**), primarily due to roads, past timber harvest, mining on all-lands, and to clearing and development on private land. Many thousands of acres of forest that drain into the reach of the mid-Klamath River that flows through the Thompson Creek-Klamath River HUC10 burned at moderate to high severity in the 2014 Beaver and Happy Camp Complex Fires. The 2014 Fires have already greatly increased the rate of sediment delivery into streams and the Klamath River (personal observation). The frequency, magnitude and duration of chronic elevated sediment delivery from surface erosion from the 2014 Fires is likely to be remain elevated for at least the next few years until vegetation gets re-established and ground cover increases, and excess fines are winnowed out of the system. The risk of acute bouts of elevated sediment delivery from mass wasting resulting from the 2014 Fire will be increased for a decade or more due to decreased evapotranspiration, decreased ground cover, increased groundwater, increased overland flow, and/or loss of soil cohesion provided by living tree roots. Modeled surface erosion risk (USLE = 0.29) and mass wasting risk (GEO = 0.49) are moderate in the Thompson Creek-Klamath River HUC10. Modeled surface erosion risk and mass wasting risk are highly elevated to over threshold

in many of the HUC10s upstream of the Thompson Creek-Klamath River HUC10.

Sediment character and regime in the Klamath River is also adversely affected by water diversions and hydropower operations (dams) up-river which: (1) adversely affects sediment transport processes in the river below the diversions and dams by decreasing stream flow and the river's ability to move sediment and to self-cleanse and (2) adversely affects sediment transport processes by preventing sediment delivery from the upper basin (above Iron Gate Dam) to the lower basin. **At-Risk**

Large Woody Debris: Because the channel of the mainstem Klamath River is so wide, even whole trees with rootwads attached often do not remain in the channel for long periods before being transported downstream by high flows, however, current levels of LWD in the mainstem Klamath River are likely considerably reduced from pre-settlement levels. Most of the type of LWD that does tend to have long in-channel residence time results from large streamside conifers that fall over into the stream with the rootwad still attached and rootwad still on the streambank or hillslope. The capacity to grow large streamside conifers and the potential for future LWD recruitment to the river has been slightly reduced within the Thompson Creek-Klamath River HUC10 because trees within or adjacent to the stream buffer RR are readily accessible to the public (permitted or not) and agencies via the Klamath River Highway that closely parallels about half of the mainstem length, via river accesses, and via riverfront private properties. Road construction and maintenance (including hazard tree removal) in stream buffers prevents large trees from growing and removes large trees that might have become LWD. On many of the streamside private properties, current land use practices removes large trees that could recruit to the river and/or precludes the growth of large trees. Compared to pre-settlement conditions, there are fewer and/or smaller logs being delivered to the mainstem from tributary watersheds because of road construction and maintenance within stream buffer, past clearcut logging within stream buffers, and clearing and/or development on private land within stream buffers.

N**ot Properly Functioning**.

Pool Frequency and Quality: Reduction of mainstem pool depth and volume due to infilling is likely occurring because: (1) excessive sediment has been delivered to the mainstem from numerous areas of high watershed disturbance upstream in the mid-Klamath sub-basin and the Scott River watershed and (2) reduced magnitude and duration of flow in the mainstem (due to upstream water management and hydropower operations) has reduced sediment transport capability. Pool quality may be reduced because of lack of LWD. **At-Risk**.

Off-Channel Habitat: There is very little unconstrained valley/channel adjacent to the Klamath River within the Thompson Creek-Klamath River HUC10 so there are few floodplains and little potential for off-channel habitat development. In the lower miles of mainstem in this HUC10 there are a few low-gradient reaches where the channel widens out that provides off-main channel salmonid habitat such as in secondary channels and braids, and depressions in the stream channel where ponds form when groundwater/streamflow gets high enough. No on-site past or current activity or management has significantly altered the channel in these small unconstrained reaches. [*However, use of these floodplain/off-channel habitat areas can be adversely affected by altered flow regime from upstream water diversions and hydropower operations. Decreased flows from up-river have decreased hydrologic connectivity between the river and off-channel habitats/floodplains, have reduced the size and temporal duration of these habitats, and have decreased ease of access to and from these critical rearing areas by juvenile salmon and steelhead. See discussion for Change in Peak Flow Indicator below*]. **At Risk** because of streamflow issues.

Refugia: This section of the Klamath River provides spawning, rearing, and migration habitats for salmon, steelhead trout, and other anadromous and resident fish species. Poor water quality in the mainstem Klamath River has been physically documented through monitoring (as is described in the Environmental Baselines in the Indicator analyses for Water Temperature, Turbidity, Substrate, and Chemical Contamination) and biologically evidenced by frequent fish kills and high incidence of disease and mortality. Water temperatures in the Klamath River mainstem reach critically high levels

for salmonids in summer and salmonids must find cooler water on hot days or during hot periods in order to survive. Klamath River summer thermal refugia is associated with tributaries having cool clear water. Cool, clear, un-polluted water from (most) mid-Klamath River tributaries function to maintain or improve water quality in the mid-Klamath River in summer. Unfortunately, flow and water quality from some of the tributaries may be diminished in summer due to water diversion. The 2014 Happy Camp Complex Fire is likely to result in further diminishment of thermal refugia by increasing water temperatures in tributaries where large swaths of riparian vegetation burned at moderate to high intensity. **At-Risk**.

Width-to-Depth Ratio: Reduction of mainstem pool depth and volume due to infilling is likely occurring because: (1) excessive sediment has been delivered to the mainstem from numerous areas of high watershed disturbance upstream in the mid-Klamath sub-basin and the Scott River watershed and (2) reduced magnitude and duration of flow in the mainstem (due to upstream water management and hydropower operations) has reduced sediment transport capability. **At-Risk**.

Streambank Condition: Several miles of the Klamath River Highway run along the north streambank of the Klamath River (from Portuguese Creek to Fort Goff Creek). Several miles of China Grade Road run along the south bank and/or within inner gorge of the Klamath River (from China Creek to Happy Camp). Besides these and a few other minor road impacts streambanks along the Klamath River in this HUC10 are relatively undisturbed in good condition. There is high density of roads in stream buffer RRs and high density of stream crossings in most of the tributary watersheds except for Fort Goff Creek, Portuguese Creek, upper Thompson Creek, and the face drainages on the south side of the river from Ladd Creek (not including Ladd Creek watershed) downstream to Joe Miles Creek. Hundreds of acres of riparian vegetation in hydrologic RRs burned at moderate to high severity in the 2014 Happy Camp Complex Fire which burned only on the south-side of the river in the Thompson Creek-Klamath River HUC10. **At-Risk**.

Floodplain Connectivity: There is very little unconstrained valley/channel adjacent to the Klamath River within the Thompson Creek-Klamath River HUC10 so there is very little floodplain. What floodplain there is has not been significantly altered. **Properly Functioning.**

Flow/Hydrology

Change in Peak/Base Flow: The flow regime in the mid-Klamath River is altered by numerous water diversions and a major hydropower operation (PacifiCorps) that are upstream from the Thompson Creek-Klamath River HUC10. Adverse changes in river flow regime have resulted in less water in spring/summer when juvenile anadromous salmonids need good flow and water quality to migrate to the ocean and/or to access off-channel habitats. The flow regime in the mid-Klamath River is Not Properly Functioning because of significant water diversion and flow regulation by dams. There are also numerous domestic water diversions from tributaries within the Thompson Creek–Klamath River HUC10 that may significantly lower base flows in some of the tributaries. Peak flows in many of the Klamath River tributaries within this HUC10 are likely elevated due to high road density and/or the 2014 Happy Camp Complex Fire. Modeled runoff risk for the entire HUC10 is moderately elevated (ERA/TOC = 0.55). **Not Properly Functioning**

Drainage Network Increase: The Klamath River corridor within the Thompson Creek-Klamath River HUC10 has low to moderate road density and several miles of valley bottom/inner gorge road. Road density is high to very high in all tributary watersheds except for Fort Goff Creek, Portuguese Creek, upper Thompson Creek, and the face drainages on the south side of the river from Ladd Creek (not including Ladd Creek watershed) downstream to Joe Miles Creek. The road system generally has low hydrologic connectivity with the stream network. There is some potential for drainage network increase due to roads because percent hydrologically-connected road ranges from 0% to 15% (median = 5%) in the HUC14 watersheds. **At-Risk**

Watershed Conditions

Road Density/Location: The Klamath River corridor within the Thompson Creek-Klamath River HUC10 has low to moderate road density and several miles of valley bottom/inner gorge road. Road density is high to very high in all tributary watersheds except for Fort Goff Creek, Portuguese Creek, upper Thompson Creek, and the face drainages on the south side of the river from Ladd Creek (not including Ladd Creek watershed) downstream to Joe Miles Creek. **At-Risk** because of the high density road areas.

Disturbance History/Regime: There is high level of disturbance from roads and vegetation management in all tributary watershed areas except for Fort Goff Creek, Portuguese Creek, upper Thompson Creek, and the face drainages on the south side of the river from Ladd Creek (not including Ladd Creek watershed) downstream to Joe Miles Creek. There is high level of disturbance in the China, Fryingpan, and Horse Creek watersheds due to large swaths of forest that burned at moderate to high severity in these watersheds in the 2014 Happy Camp Complex Fire. There is a low level of watershed disturbance from the 2012 Fort Goff Fire that burned mostly at low severity from Thompson Creek east to Seiad Creek. Modeled watershed disturbance at the HUC10 scale is slightly to moderately elevated due to roads, the 2014 Fire, vegetation management, and firelines – in that order: surface erosion risk (USLE = 0.29); mass wasting risk (GEO = 0.49); and runoff risk (ERA/TOC = 0.43). **At-Risk.**

Riparian Reserves: Several miles of the Klamath River Highway run along the north streambank of the Klamath River (from Portuguese Creek to Fort Goff Creek). Several miles of China Grade Road run along the south bank and/or within inner gorge of the Klamath River (from China Creek to Happy Camp). Besides these and a few other minor road impacts, stream course RRs along the Klamath River in the Thompson Creek-Klamath River HUC10 are relatively undisturbed and in good condition. Riparian reserves are in good condition in the Fort Goff Creek watershed, Portuguese Creek watershed, upper Thompson Creek, and the face drainages on the south side of the river from Ladd Creek (not including Ladd Creek watershed) downstream to Joe Miles Creek because these areas are roadless and not much has recently burned at moderate to high severity. Stream buffer RRs in the China, Fryingpan, and Horse Creek watersheds are generally in poor condition because there is high road and stream crossing density and secondarily because about 100 acres of stream buffer RR burned at moderate to high severity in each watershed. Stream course RRs are in fair condition in the remaining tributary watersheds because road density is medium-high and there have been no recent moderate to high severity wildfires of any significance. **At-Risk**

Refer to the following 7th field matrices for more detailed information on this watershed:

- China Creek HUC14 environmental baseline summary table
- Fort Goff Creek HUC14 environmental baseline summary table
- Horse Creek HUC14 environmental baseline summary table
- Portuguese Creek HUC14 environmental baseline summary table

Appendix E: Project Design Features and Best Management Practices

Project Design Features (as submitted April 13, 2015)

Project Design Feature	Description	Applicable Alternatives and Units
Watershed - 1	The project is proposed to take place during the normal operating season (NOS) that is defined as May 1 to October 31. All ground disturbing activities, whether inside or outside of the NOS, will be implemented according to the Forest's Wet Weather Operation Standards (Klamath National Forest, 2002).	All units where applicable
Watershed - 2	Areas where soil has been disturbed by project activities within Riparian Reserves must be stabilized prior to the end of the normal operating season, prior to sunset if the National Weather Service forecast is a "chance" (30%) of rain within the next 24 hours, or at the conclusion of the operations, whichever is sooner. This includes skid trails that cross swales (i.e. linear depressions perpendicular to the slope contour that do not meet definition for designation as a Riparian Reserve). Restoration generally consists of removing excess sediment, reshaping and waterbarring former approaches, and spreading slash on the former crossing.	All units where applicable
Watershed - 3	Project Riparian Reserves are established in the following manner per the Forest Plan (site tree for Salmon and Happy Camp districts is 170 feet, site tree for Scott and Oak Knoll districts is 150 feet): For fish-bearing streams, it is the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance (600 feet total, including both sides of the stream), whichever is greatest. For Salmon and Happy Camp ranger districts, this will be 340 feet (680 feet total). For permanently flowing non-fish-bearing streams, it is the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance (300 feet total, including both sides of the stream), whichever is greatest. For Salmon and Happy Camp ranger districts, this will be 170 feet (340 feet total) and 150 feet for the Oak Knoll and Scott River Ranger District. For intermittent streams, the stream channel and extending to the top of the inner gorge, or extension from the edges of the stream channel to a distance equal to the height of one site potential tree, or 100 feet slope distance, whichever is greatest. For unstable lands, it is the extent of unstable and potentially unstable areas. Consistent with Forest Plan direction, riparian reserves for wetlands and springs will be defined by the edge of the feature out to a distance equal to 1 site potential tree. These riparian reservess will be flagged and avoided during salvage harvest.	All units where applicable

Project Design Feature	Description	Applicable Alternatives and Units
Watershed - 4	Tractors and mechanical harvesters will be excluded from all riparian reserves associated with stream channels, active landslides, inner gorges, and toe zones of dormant landslide deposits. Hazard tree removal units are the exception. In Hazard tree units the equipment will be excluded from the inner 50 feet of the non-fish bearing riparian reserve, one site tree for fish bearing streams and in the perimeter of all active landslides and toe zones of dormant landslides. Equipment will be excluded from wetlands or wet meadows (excluding small springs and seeps). To limit slope disturbance, inner gorge terrain (> 65% slope) that extends beyond riparian reserves will be buffered by 20-foot slope distance and excluded from mechanical equipment activities. In areas where treatments may conflict, a hydrologist will be consulted.	All units where applicable
Watershed - 5	New temporary roads or landings will not be constructed in any riparian reserve associated with stream channels, on toe zones of landslides, active landslides or inner gorges. Exceptions for this project design feature for Alternative 2: Landings # DZ03, DZ10, DZ23, L043, L044, and L090.	All units where applicable
Watershed - 6	There will be no salvage logging on active landslides.	All units where applicable
Watershed - 7	Limit equipment disturbance within 20 feet on either side of swales by minimizing equipment crossings and avoiding running trails up the axis of swales, except at designated crossings.	All units where applicable
Watershed - 8	In salvage units and subsequent site preparation, skidding equipment will be restricted to slopes less than 35 percent. Skid trails that connect benches in dormant landslide terrain can have minor portions of the skid trails on slopes greater than 35 percent. In site preparation units (where no salvage will occur) felling and skidding equipment will be restricted to slopes less than 45% in non-granitic and non-schist soil types (see soils report for locations).	All salvage and site preparation units
Watershed - 9	Ground-based harvest equipment will be limited to 35% slopes, except when moving from one bench to another on dormant landslide terrain. In addition, ground-based equipment can travel up to 100 feet on slopes 35 to 45 percent.	All units where applicable
Watershed - 10	During site preparation, material greater than 8’’ inches in diameter would not be removed unless needed to reduce 1,000 hour fuel loading to seven tons per acre, retain as close to seven tons per acre as possible.	All units where applicable
Watershed - 11	Site preparation treatments would be designed to meet soils management direction in the Forest Plan. This may include use of low ground pressure equipment, retaining slash and large woody material and implementing hand treatments instead of mechanical.	All units where applicable
Watershed - 12	All hazard trees cut within 25 feet of a stream channel will be left on site unless it continues to pose a threat to safety or accessibility (see watershed-4 for equipment exclusion restrictions). Along fish-bearing stream reaches, all hazard trees greater than 26 inches in diameter at breast height within the first site tree (150-170 feet) will be left on site unless after felling, it continues to pose a threat to safety, infrastructure, forest road drainage system integrity or accessibility.	All units where applicable
Watershed - 13	Live trees directly rooted into the banks or otherwise integral to the stability of the channel bank will not be felled unless they pose an overhead hazard and, if felled, will be left on site unless this poses a hazard on the ground per Forest Service safety requirements.	All units where applicable
Watershed - 14	Directional felling will be used to protect streambanks where hazard trees need to be mitigated for public or employee safety.	All units where applicable

Project Design Feature	Description	Applicable Alternatives and Units
Watershed - 15	Improvements to existing system roads in the project area will avoid over-steepened road cuts where possible, minimize sidecasting, and maintain ditches, cross drains, and any outsloped road segments.	All units where applicable
Watershed - 16	Roads will be watered as appropriate to maintain road fines on site. Other materials may be used for dust abatement as approved by the Forest Service.	All units where applicable
Watershed - 17	Upgrades or improvements to stream crossings will be built to Forest Plan standards.	All units where applicable
Watershed - 18	Activities which require culvert replacement or removal will occur during the least critical periods for water and aquatic resources: when streams are dry or during low-water conditions; and in compliance with spawning and breeding season restrictions.	All units where applicable
Watershed - 19	Legacy sediment site treatments within or adjacent to streams will have erosion-prevention techniques applied such as silt fences, straw waddles, or mulch to minimize the risk of discharge.	All units where applicable
Watershed - 20	All project-related temporary structures, materials and project-related debris will not be stored for any length of time on active landslides and will be removed from riparian areas and stream channels prior to winter shutdown.	All units where applicable
Watershed - 21	For legacy sediment site repairs, fill materials generated will be reincorporated back into subgrade to the extent possible; all excess fill materials will be spoiled at a site reviewed and approved by Forest Service botanist, watershed, and heritage specialists.	All legacy site repair where applicable
Watershed - 22	Following harvest activities achieve at least 50 percent effective soil cover on new temporary roads and block them after the harvest season (prior to the first winter after use). New temporary roads will also be sub-soiled (or tilled) after use. All temporary roads (new, existing or re-opened decommissioned roads) will have the takeoffs from system road obliterated or blocked to avoid unauthorized use. All temporary roads will be hydrologically stabilized including removal of culverts and fills at stream crossings, out-sloping of road surfaces, and proper construction of water bars. Erosion and sedimentation control structures (water bars) will be maintained and repaired per the guidance in the Forest Service Handbook 2409.15 R5 Supplement.	New temp roads: 6, 7, 8, 10, 11, 12, 20, 27
Watershed - 23	Existing landings will be used to the extent possible. Existing landings in stream-course riparian reserves will not be expanded towards stream channels, or on to active landslides, or where vegetation that provides shade to a stream would need to be cut. Existing landings in riparian reserves will be shaped and treated for erosion control at the end of each season of use, and hydrologically restored at project completion (including subsoiling and covering with slash/mulch as needed). Reused landings in riparian reserves will have site specific erosion control measures to reduce risk of sediment delivery into streams. During opening or construction of any landings, material will not be sidecast into intermittent or perennial stream channels. At project conclusion, landings will be configured for long-term drainage and stability by reestablishing natural runoff patterns. All landings will be covered with at least 50 percent effective soil cover. Use of certified weed free materials including straw, wood chips, or mulch may be used where on-site material is insufficient.	All units where applicable
Watershed - 24	Refueling will not take place within riparian reserves except at designated landings in locations where most disconnected from water resources. A spill containment kit will be in place where refueling and servicing take place.	All units where applicable

Project Design Feature	Description	Applicable Alternatives and Units
Watershed - 25	Skid trail erosion control work will be kept current during implementation. Erosion control and drainage of skid trails will be complete prior to shutting down operations due to wet weather or at project completion.	All units where applicable
Watershed - 26	Use existing skid trails instead of building new skid trails unless using existing skid trails will have greater negative effects. Space skid trails at least 75 feet apart, except near landings and where trails converge. Use no skid trails in areas in which ground-based mechanical equipment is excluded. Designation of new skid trails will be approved by a Timber Sale Administrator. Erosion and sedimentation control structure will be maintained and repaired per the guidance in the Forest Service Handbook 2409.15 R5 Supplement.	All units where applicable
Watershed - 27	No full bench skid trails will be constructed. Full bench skid trails have the entire skid trail cut into the hillslope.	All units where applicable
Watershed - 28	Locations where skid trails intersect roads will be obliterated or effectively blocked to vehicle access.	All units where applicable
Watershed - 29	Skyline corridors will be placed on the landscape as to minimize disturbance to active landslides, inner gorges and toe zones of dormant landslide deposits. All skyline and ground-based yarding will require one-end suspension in corridors and on skid trails. Corridors for skyline yarding that are parallel to the stream channel will be placed outside of the riparian reserve. The corridor may cross the stream channel with full suspension of logs within ten feet from the stream bank. Apply erosion control measures as necessary in cable corridors to control erosion and runoff. This could include hand construction of water bars and /or spreading slash from adjacent areas.	All units where applicable
Watershed - 30	Where skidding occurs through units with less than 50 percent soil cover, mulch skid trails of greater than 15 percent slope, to achieve at least 50 percent effective soil cover on skid trails (approximately 40 acres across the project area may require this). Effective soil cover could include plant litter, woody material in contact with the soil, living vegetation, and rock fragments with a diameter of ½ to 3 inches. Use of certified weed free materials including straw, wood chips, or mulch may be used where on-site material is insufficient. Masticators will cover their tracks/traces with masticated slash upon exiting fuels treatment units/areas.	Based on soil burn severity data, these units are most likely to require this: 225, 264, 402, 525, 528, 540, 1109, 1129, 1136, 1140, 1142, 1151, and 1155.
Watershed - 31	Prescribed fire effects in riparian reserves will mimic a low intensity backing fire, except for handpiles where higher intensity may occur to consume pile material. Ignition of underburns will generally not occur in riparian reserves. Approval by the District Fish Biologist is needed for underburn riparian reserve ignitions.	All units where applicable
Watershed - 32	Handpiles and windrows in riparian reserves will be placed in a checkerboard pattern whenever possible (not piled directly above another). Handpiles will be less than six feet in diameter and will be more than 15 feet away from intermittent streams and 30 feet away from perennial streams.	All units where applicable
Watershed - 33	For underburning, hand-line construction in riparian vegetation shall be avoided and in general should be farther than 25 feet from stream channels. Handlines will be mitigated (waterbarred and covered with organic material) immediately following prescribed burning, when safe to do so.	All units where applicable

Project Design Feature	Description	Applicable Alternatives and Units
Watershed - 34	Draft water only at sites designated by the Forest Service. Decisions related to where water drafting occurs will be coordinated with a Forest Service fisheries biologist so that potential impacts to anadromous fish, and the thermal refugia they rely upon, are sufficiently minimized. Sites that are not likely to have rearing Coho salmon present will be prioritized for use, such as mainstem sites on the Klamath, Scott, and Salmon rivers. Priority will also be given to sites that involve drafting relatively warmer waters in mainstem rivers; drafting from tributaries and colder water sources, especially in their lower reaches, will be avoided particularly during late summer and early fall (when fish survival is dependent upon thermal refugia). Water storage facilities such as foldable tanks are encouraged and will be assessed for sites with moderate flows that simultaneously support rearing SONCC coho salmon, and may be subject to high drafting use (e. g., Walker Creek). Project-related water drafting will be monitored, and shifted away from streams if their baseflows will no longer sustain drafting-related water withdrawal consistent with PDFs. The following creeks will be avoided, due to their small size, small summer base flows, and consistent presence of rearing SONCC Coho salmon - Tom Martin Cr, O'Neil Cr, Little Horse Cr, and China Cr. <u>When drafting from waters designated as coho salmon Critical Habitat:</u> *NOAA Fisheries Water Drafting Specifications (2001) apply* 1. Intakes will be screened with 3/32" mesh for rounded or square openings, or 1/16" mesh for slotted openings. When in habitat potentially occupied by steelhead trout, intakes will be screened with 1/8" mesh size. Wetted surface area of the screen or fish-exclusion device shall be proportional to the pump rate to ensure that water velocity at the screen surface does not exceed 0.33 feet/second. a. Use of a NOAA approved fish screen will ensure the above specifications are met. 2. Fish screen will be placed parallel to flow. 3. Pumping rate will not exceed 350 gallons-per-minute or 10% of the flow of the anadromous stream drafted from. 4. Pumping will be terminated when tank is full. Additional applicable specifications: • There will be no modification/improvement of drafting sites in Coho Critical Habitat. Water drafting by more than one truck shall not occur simultaneously. <u>When drafting from waters that are not Coho Salmon critical habitat, but do contain fish:</u> *Forest Service Best Management Practices (BMP) Handbook direction applies (BMP 2.5)* 1. For fish-bearing streams, the water drafting rate should not exceed 350 gallons per minute for streamflow greater than or equal to 4.0 cubic feet per second (cfs). 2. Below 4.0 cfs, drafting rates should not exceed 20 percent of surface flows. 3. Water drafting should cease when bypass surface flows drop below 1.5 cfs. 4. Intakes, for trucks and tanks, shall be placed parallel to the flow of water and screened, with opening size consistent with the protection of aquatic species of interest. 5.Fish-bearing streams that are temporarily dammed to create a drafting pool shall provide fish passage for all life stages of fish.	All units where applicable
	<u>When drafting from non-fish-bearing waters:</u> *Forest Service BMP Handbook direction applies (BMP 2.5)* • Drafting rate should not exceed 350 gallons per minute for stream flow greater than or equal to 2.0 cubic feet/second. • Drafting rate should not exceed 50 percent of surface flow. • Drafting should cease when bypass surface flow drops below ten gallons per minute.	

Project Design Feature	Description	Applicable Alternatives and Units
Watershed – 35	Rock and gravel will be applied to drafting sites if it is needed to prevent stream sedimentation. Water drafting sites located in non-fish-bearing waters only may include minor instream modification, such as fine sediment removal and building of board/plastic dams. All boards and plastic will be removed after use. Water drafting sites located within fish-bearing stream segments may not be modified, except rocking the approach to prevent sedimentation.	All units where applicable

Best Management Practices (as submitted April 13, 2015)

Best Management Practices (BMPs) were developed to comply with Section 208 of the Clean Water Act. BMPs have been certified by the State Water Quality Resources Control Board and approved by the Environmental Protection Agency (EPA) as the most effective way of protecting water quality from impacts stemming from non-point sources of pollution. These practices have been applied to forest activities and have been found to be effective in protecting water quality within the Klamath National Forest (Forest). Specifically, effective application of the Region 5 Forest Service BMPs has been found to maintain water quality that is in conformance with the Water Quality Objectives in the North Coast Regional Water Quality Control Board's Basin Plan (http://www.waterboards.ca.gov/northcoast/water_issues/programs/basin_plan/).

Region 5 Forest Service BMPs have been monitored and modified since their original implementation in 1979 to make them more effective. Numerous on-site evaluations by the North Coast Region Water Quality Control Board have found the practices to be effective in maintaining water quality and protecting beneficial uses.

The Forest monitors the implementation and effectiveness of BMPs on randomly selected projects each year. From 2000 to 2012, BMP implementation requirement were met on 78-100 percent (91 percent average) of sites sampled, and BMP effectiveness requirements were met on 88-100 percent (94 percent average) of the sites sampled (USDA Forest Service, 2013c). The critical BMP evaluation is *effectiveness* which is a field evaluation to determine how well the BMP worked to prevent sedimentation. The success rate for effectiveness has been in the high 80s and 90s each year since 1993.

Best Management Practices first identified and utilized by the Klamath National Forest are listed in appendix D of the Forest Plan. These basic BMPs have been revised over the years, and are currently similar to those listed in the 2012 Region 5 BMP update in Chapter 10 of the Soil and Water Conservation Handbook, which additionally includes a narrative and objective of each (USDA USFS 2011); and where there are differences, direction is to employ the newer BMP list. The following 'on-the-ground' prescriptions below are incorporated into the project (see chapter 2 of draft EIS).

BMP 1.1 – Timber Sale Planning Process:

> Requires the Interdisciplinary Team (interdisciplinary team) to consider methods of reducing water quality impacts during the planning phase of a project. This is accomplished during the planning process of the Timber Sale project.

- An interdisciplinary team review was completed and project design features have been incorporated into the project design (See Chapter 2 of the DEIS).

BMP 1.2 – Timber Harvest Unit Design:

Requires the interdisciplinary team to consider methods of reducing water quality impacts due to changes in unit design. This is accomplished during the planning phase of a project. Examples of design changes are restricting timing of tree removal and utilizing less impacting yarding systems.

- An interdisciplinary team review was completed and project design features have been incorporated into the project design (See Chapter 2 of the DEIS).

BMP 1.3 – Use of Erosion Hazard Rating for Unit Design:

Identifies high or very high erosion hazard areas and adjust management activities to prevent downstream water quality impacts; and to increase soil cover for those areas that have a high risk of contributing sediment into streams. This is done during the planning and layout phase of the project.

- Based on field review and site data (percent slope distribution, soil texture), the Forest Soil Scientist determined the surface erosion hazard rating for each treatment unit and prescribed logging systems and soil cover needs based on the erosion hazard rating.

BMP 1.4 – Use of Sale Area Maps for Designating Water Quality Protection:

Identifies sensitive areas and water uses as part of the Timber Sale contract to assist operators in locating water concerns and applying protection methods. This is accomplished during contract preparation and implemented during layout of the sale.

- The Sale Area Map will include all protected stream-courses, unstable land features, springs, wetlands, meadows, water drafting sites, landings, temporary roads, and logging system for each unit.

BMP 1.5 – Limiting Operating Period of Timber Sale:

To prevent soil compaction and erosion from operations during wet weather; and to ensure placement of erosion control structures prior to the onset of winter to reduce water quality impacts. This is accomplished during the timber sale operations.

- The project is proposed to take place during the normal operating season (NOS) that is defined as May 1 to October 31. All ground disturbing activities, whether inside or outside of the NOS, will be implemented according to the Forest's Wet Weather Operation Standards (Klamath National Forest, 2002).
- Areas where soil has been disturbed by project activities within Riparian Reserves must be stabilized prior to the end of the normal operating season, prior to sunset if the National Weather Service forecast is a "chance" (30 percent) of rain within the next 24 hours, or at the conclusion of the operations, whichever is sooner. This includes skid trails that cross swales (i.e. linear depressions perpendicular to the slope contour that do not meet definition for designation as a Riparian Reserve). Restoration generally consists of removing excess sediment, reshaping and waterbarring former approaches, and spreading slash on the former crossing.

BMP 1.6 – Protection of Unstable Lands:

Provides for special treatment of unstable areas to avoid triggering mass slope failure with resultant erosion and sedimentation.

- Tractors and mechanical harvesters will be excluded from all Riparian Reserves associated with stream channels, active landslides, inner gorges, and toe zones of dormant landslide deposits. Hazard tree removal units are the exception. In Hazard tree units the equipment will be excluded from the inner 50 feet of the non-fish bearing Riparian Reserve, one site tree for fish bearing streams and in the perimeter of all active landslides and toe zones of dormant landslides.
- To limit slope disturbance, inner gorge terrain (greater than 65 percent slope) that extends beyond Riparian Reserves will be buffered by 20-foot slope distance and excluded from mechanical equipment activities. In areas where treatments may conflict, a hydrologist will be consulted.
- There will be no salvage logging on active landslides.
- Limit equipment disturbance within 20 feet on either side of swales by minimizing equipment crossings and avoiding running trails up the axis of swales, except at designated crossings.

BMP 1.8 – Streamside Management Zone Designation:

Designates zones adjacent to water and/or riparian areas as zones of special management. This is accomplished during the planning and layout phase of the project.

- Project Riparian Reserves are established in the following manner per the Forest Plan (site tree for Salmon and Happy Camp districts is 170 feet, site tree for Scott and Oak Knoll districts is 150 feet):
    - For fish-bearing streams, it is the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to a distance equal to the height of two site-potential trees, or 300 feet slope distance (600 feet total, including both sides of the stream), whichever is greatest. For Salmon and Happy Camp ranger districts, this will be 340 feet (680 feet total).
    - For permanently flowing nonfish-bearing streams, it is the area on each side of the stream extending from the edges of the active stream channel to the top of the inner gorge, or to the outer edges of the 100-year floodplain, or to a distance equal to the height of one site-potential tree, or 150 feet slope distance (300 feet total, including both sides of the stream), whichever is greatest. For Salmon and Happy Camp ranger districts, this will be 170 feet (340 feet total) and 150 feet for the Oak Knoll and Scott River Ranger District.
    - For intermittent streams, , the stream channel and extending to the top of the inner gorge, or extension from the edges of the stream channel to a distance equal to the height of one site potential tree, or 100 feet slope distance, whichever is greatest. For unstable lands, it is the extent of unstable and potentially unstable areas.
    - Consistent with Forest Plan direction, Riparian Reserves for wetlands and springs will be defined by the edge of the feature out to a distance equal to 1 site potential tree. These RRs will be flagged and avoided during salvage harvest.

BMP 1.9 – Determining Tractor Loggable Ground:

Minimize erosion and sedimentation resulting from ground disturbance of tractor logging systems.

- Ground-based harvest equipment will be limited to 35 percent slopes, except when moving from one bench to another on dormant landslide terrain. In addition, ground-based equipment can travel up to 100 feet on slopes 35 to 45 percent.
- Site preparation treatments would be designed to meet soils management direction in the KNF Forest Plan. This may include use of low ground pressure equipment, retaining slash and large woody material and implementing hand treatments instead of mechanical.

BMP 1.10 – Tractor Skidding Design:

Designates a tractor skid pattern over steepened areas, designates tractor crossings, and reduces skid patterns in sensitive areas to reduce erosion and compaction. This is accomplished during the sale layout and operations phase of the project.

- In salvage units and subsequent site preparation, skidding equipment will be restricted to slopes less than 35 percent. Skid trails that connect benches in dormant landslide terrain can have minor portions of the skid trails on slopes greater than 35 percent.
- In site preparation units (where no salvage will occur) felling and skidding equipment will be restricted to slopes less than 45 percent in non-granitic and non-schist soil types (see soils report for locations).
- Use existing skid trails instead of building new skid trails unless using existing skid trails will have greater negative effects. Space skid trails at least 75 feet apart, except near landings and where trails converge. Use no skid trails in areas in which ground-based mechanical equipment is excluded (Designation of new skid trails will be approved by a Timber Sale Administrator. Erosion and sedimentation control structure will be maintained and repaired per the guidance in the Forest Service Handbook 2409.15 R5 Supplement.
- No full bench skid trails will be constructed. Full bench skid trails have the entire skid trail cut into the hillslope.
- Locations where skid trails intersect roads will be obliterated or effectively blocked to vehicle access.

BMP 1.11 – Suspended Log Yarding in Timber Harvesting:

Protect the soil mantle from excessive disturbance; maintain the integrity of the Streamside Management Zone and other sensitive watershed areas, and to control erosion on cable corridors.

- Skyline corridors will be placed on the landscape as to minimize disturbance to active landslides, inner gorges and toe zones of dormant landslide deposits. All skyline and ground-based yarding will require one-end suspension in corridors and on skid trails. Corridors for skyline yarding that are parallel to the stream channel will be placed outside of the Riparian Reserve. The corridor may cross the stream channel with full suspension of logs within ten feet from the stream bank. Apply erosion control measures as necessary in cable corridors to control erosion and

runoff. This could include hand construction of water bars and /or spreading slash from adjacent areas.

BMP 1.12 – Log Landing Location:

Locate new landings or reuse existing landings in such a way as to avoid watershed impacts and associated water quality degradation.

- See BMP 2.4
- Existing landings will be used to the extent possible. Existing landings in stream-course Riparian Reserves will not be expanded towards stream channels, or on to active landslides, or where vegetation that provides shade to a stream would need to be cut. Existing landings in Riparian Reserves will be shaped and treated for erosion control at the end of each season of use, and hydrologically restored at project completion (including subsoiling and covering with slash/mulch as needed). Reused landings in Riparian Reserves will have site specific erosion control measures to reduce risk of sediment delivery into streams.
- During opening or construction of any landings, material will not be sidecast into intermittent or perennial stream channels.
- At project conclusion, landings will be configured for long-term drainage and stability by reestablishing natural runoff patterns. All landings will be covered with at least 50 percent effective soil cover. Use of certified weed free materials including straw, wood chips, or mulch may be used where on-site material is insufficient.

BMP 1.13 – Erosion Prevention and Control Measures During Timber Sale Operations:

Ensures that Purchasers operations shall be conducted reasonably to minimize soil erosion. This is accomplished during the pre-operations meeting with the purchaser, and throughout the operations phase of the timber sale.

- Erosion control measures are discussed during the pre-operations meeting with the purchaser and the Forest Service. They are updated throughout the operations phase of the timber sale.
- The Klamath Wet Weather Operation Standards (USDA Forest Service 2002) will be used for all project activities (harvest, hauling, planting).

BMP 1.16 – Log Landing Erosion Prevention and Control:

Works to reduce erosion and subsequent impacts sedimentation from log landings. Timber Sale Contract provide for erosion prevention and control measures on all landings. This is best done by design of landing drainage measures during the planning phase of the project, and implemented during the operations phase.

- See BMP 1.12.

BMP 1.17 – Erosion Control on Skid Trails:

Employs preventive measures such as drainage structures to reduce water concentration and erosion. This is accomplished during the operations phase of the project. Because of the timing of this project, pre-staging of straw bales for timely construction of water bars will be called for.

- Where skidding occurs through units with less than 50 percent soil cover, mulch skid trails of greater than 15 percent slope, to achieve at least 50 percent effective

soil cover on skid trails (approximately 40 acres across the project area may require this). Effective soil cover could include plant litter, woody material in contact with the soil, living vegetation, and rock fragments with a diameter of ½ to 3 inches. Use of certified weed free materials including straw, wood chips, or mulch may be used where on-site material is insufficient.

BMP 1.18- Meadow Protection during Timber Harvest:

The objective is to avoid damage to ground cover, soil and hydrologic function of meadows.

- Equipment will be excluded from wetlands or wet meadows (excluding small springs and seeps).

BMP 1.19 – Streamcourse Protection:

Protects the natural flow of streams and reduces the entry of sediment and any other pollutants into streams. The location of stream crossings must be agreed to by the Sale Administrator and the Hydrologist. The accomplishment of the objective of this measure is during the operations phase of the project.

- Tractors and mechanical harvesters will be excluded from all Riparian Reserves associated with stream channels, active landslides, inner gorges, and toe zones of dormant landslide deposits. Hazard tree removal units are the exception. In Hazard tree units the equipment will be excluded from the inner 50 feet of the non-fish bearing Riparian Reserve, one site tree for fish bearing streams and in the perimeter of all active landslides and toe zones of dormant landslides.
- To limit slope disturbance, inner gorge terrain (greater than 65 percent slope) that extends beyond Riparian Reserves will be buffered by 20-foot slope distance and excluded from mechanical equipment activities. In areas where treatments may conflict, a hydrologist will be consulted.
- All hazard trees cut within 25 feet of a stream channel will be left on site unless it continues to pose a threat to safety or accessibility (See watershed-4 for equipment exclusion restrictions). Along fish-bearing stream reaches, all hazard trees greater than 26 inches in diameter at breast height within the first site tree (150-170 feet) will be left on site unless after felling, it continues to pose a threat to safety, infrastructure, forest road drainage system integrity or accessibility.
- Live trees directly rooted into the banks or otherwise integral to the stability of the channel bank will not be felled unless they pose an overhead hazard and, if felled, will be left on site unless this poses a hazard on the ground per Forest Service safety requirements.
- Directional felling will be used to protect streambanks where hazard trees need to be mitigated for public or employee safety.

BMP 1.20 – Erosion Control Structure Maintenance:

Requires periodic inspection of erosion control structures to assess maintenance needs and effectiveness. This is accomplished during the operations and post-operations phase of the project; this ensures the adequacy of erosion control measures.

- Skid trail erosion control work will be kept current during implementation. Erosion control and drainage of skid trails will be complete prior to shutting down operations due to wet weather or at project completion.

BMP 1.21 – Acceptance of Erosion Control Measures Before Timber Sale Closure:

Erosion control measures are inspected for adequacy to ensure erosion control as planned. This is accomplished during the post-operations phase of the project during the contract final inspection.

- At project completion, permanent operating water bars will be installed and/or repaired as necessary on all skid trails, and slash scattered on all skid trails if necessary.
- The Timber Sale Administrator will inspect the Erosion Control Measures for compliance with contract.

BMP 2.4 – Road Maintenance and Operations (Temporary Roads):

The objective is to improve road slope stabilization by applying mechanical and vegetative measures. This is accomplished during the operations phase of the project.

- New temporary roads or landings will not be constructed in any Riparian Reserve associated with stream channels, on toe zones of landslides, active landslides or inner gorges. Exceptions for this project design feature for Alternative 2: Landings # DZ03, DZ10, DZ23, L043, L044, and L090. Further exceptions may be approved if they meet the criteria described in the hydrology effects analysis.
- Following harvest activities achieve at least 50 percent effective soil cover on new temporary roads and block them after the harvest season (prior to the first winter after use). New temporary roads will also be sub-soiled (or tilled) after use.
- All temporary roads (new, existing or re-opened decommissioned roads) will have the takeoffs from system road obliterated or blocked to avoid unauthorized use. All temporary roads will be hydrologically stabilized including removal of culverts and fills at stream crossings, out-sloping of road surfaces, and proper construction of water bars. Erosion and sedimentation control structures (water bars) will be maintained and repaired per the guidance in the Forest Service Handbook 2409.15 R5 Supplement.

BMP 2.4 – Road Maintenance and Operations (System Roads)

- Improvements to existing system roads in the project area will avoid over-steepened road cuts where possible, minimize sidecasting, and maintain ditches, cross drains, and any outsloped road segments.
- Roads will be watered as appropriate to maintain road fines on site. Other materials may be used for dust abatement as approved by the Forest Service.
- Upgrades or improvements to stream crossings will be built to Forest Plan standards.
- Activities which require culvert replacement or removal will occur during the least critical periods for water and aquatic resources: when streams are dry or during low-water conditions; and in compliance with spawning and breeding season restrictions.

- Legacy sediment site treatments within or adjacent to streams will have erosion-prevention techniques applied such as silt fences, straw waddles, or mulch to minimize the risk of discharge.

  All project-related temporary structures, materials and project-related debris will be removed from riparian areas and stream channels prior to winter shutdown.
  For legacy sediment site repairs, fill materials generated will be reincorporated back into subgrade to the extent possible; all excess fill materials will be spoiled at a site reviewed and approved by Forest Service botanist, watershed, and heritage specialists.

BMP 2.5 - Water Source Development Consistent with Water Quality Protection:

The objective is to limit and mitigate the effects of water source development through the planning of impoundments and withdrawals.

Draft water only at sites designated by the Forest Service.

- When drafting from waters designated as coho salmon Critical Habitat: NOAA Fisheries Water Drafting Specifications (2001) apply
- Intakes will be screened with 3/32" mesh for rounded or square openings, or 1/16" mesh for slotted openings. When in habitat potentially occupied by steelhead trout, intakes will be screened with 1/8" mesh size. Wetted surface area of the screen or fish-exclusion device shall be proportional to the pump rate to ensure that water velocity at the screen surface does not exceed 0.33 feet/second.

  1. Use of a NOAA approved fish screen will ensure the above specifications are met.
  2. Fish screen will be placed parallel to flow.
  3. Pumping rate will not exceed 350 gallons-per-minute or 10 percent of the flow of the anadromous stream drafted from.
  4. Pumping will be terminated when tank is full.
  5. Additional applicable specifications:
  6. There will be no modification/improvement of drafting sites in Coho Critical Habitat.

- Water drafting by more than one truck shall not occur simultaneously.
- When drafting from waters that are not coho salmon Critical Habitat, but do contain fish:

  1. For fish-bearing streams, the water drafting rate should not exceed 350 gallons per minute for streamflow greater than or equal to 4.0 cubic feet per second (cfs).
  2. Below 4.0 cfs, drafting rates should not exceed 20 percent of surface flows.
  3. Water drafting should cease when bypass surface flows drop below 1.5 cfs.
  4. Intakes, for trucks and tanks, shall be placed parallel to the flow of water and screened, with opening size consistent with the protection of aquatic species of interest.
  5. Fish-bearing streams that are temporarily dammed to create a drafting pool shall provide fish passage for all life stages of fish.
  6. When drafting from non-fish-bearing waters:
  7. Drafting rate should not exceed 350 gallons per minute for stream flow greater than or equal to 2.0 cubic feet/second.

8. Drafting rate should not exceed 50 percent of surface flow.
9. Drafting should cease when bypass surface flow drops below ten gallons per minute.
10. Drafting by more than one truck shall not occur simultaneously.

- Rock and gravel will be applied to drafting sites if it is needed to prevent stream sedimentation.
- Water drafting sites located in non-fish-bearing waters only may include minor instream modification, such as fine sediment removal and building of board/plastic dams. All boards and plastic will be removed after use.
- Water drafting sites located within fish-bearing stream segments may not be modified, except rocking the approach to prevent sedimentation.

BMP 2.11 - Servicing and Refueling of Equipment:

Prevent fuels, lubricants, cleaners, and other harmful materials from discharging into nearby surface waters or infiltrating through soils to contaminate groundwater resources.

- Refueling will not take place within Riparian Reserves except at designated landings in locations where most disconnected from water resources. A spill containment kit will be in place where refueling and servicing take place.

BMP 2.13 – Erosion Control Plan:

Effectively limit and mitigate erosion and sedimentation from any ground-disturbing activities, through planning prior to commencement of project activity, and through project management and administration during project implementation.

- An Erosion Control Plan will be completed prior to project implementation.
- The Forest's Wet Weather Operations Standards are included in the Erosion Control Plan.

BMP 5.2 – Slope Limitations for Mechanized Equipment Operations:

The objective is to reduce gully and sheet erosion and associated sediment production by limiting tractor use.

- See BMP 1.9 and 1.10.

BMP 5.5 – Disposal of Organic Debris:

The objective is to prevent gully and surface erosion with associated reduction if sediment production and turbidity during and after treatment.

- During site preparation, material greater than 8’’ inches in diameter would not be removed unless needed to reduce 1,000 hour fuel loading to 7 tons per acre, retain as close to 7 tons per acre as possible.

BMP 5.6 – Soil Moisture Limitations for Mechanical Equipment Operations:

The objective is to prevent soil compaction, rutting, and gulling that may result in increased sedimentation and turbidity.

- All ground based equipment will follow the Wet Weather Operation Standards.

BMP 6.3 Protection of Water Quality from Prescribed Burning Effects:

The objective is to maintain soil productivity; minimize erosion; minimize ash, sediment, nutrients, and debris from entering water bodies.

- Prescribed fire effects in Riparian Reserves will mimic a low intensity backing fire, except for handpiles where higher intensity may occur to consume pile material. Ignition of underburns will generally not occur in Riparian Reserves. Approval by the District Fish Biologist is needed for underburn Riparian Reserve ignitions.
- Handpiles and windrows in Riparian Reserves will be placed in a checkerboard pattern whenever possible (not piled directly above another). Handpiles will be less than 6 feet in diameter and will be more than 15 feet away from intermittent streams and 30 feet away from perennial streams.
- For underburning, hand-line construction in riparian vegetation shall be avoided and in general should be farther than 25 feet from stream channels. Handlines will be mitigated (waterbarred and covered with organic material) immediately following prescribed burning, when safe to do so.

References for Best Management Practices

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Appendix F: Life History and Biological Requirements

Coho Salmon

General life history information and biological requirements of Southern Oregon/Northern California Coastal (SONCC) Coho salmon have been described in various documents (Hassler 1987; Sandercock 1991; Weitkamp, *et al*. 1995) as well as NOAA-Fisheries' final rule listing SONCC Coho salmon (May 6, 1997; 62 FR 24588).

Coho salmon enter the mainstem of the Klamath River for spawning typically in their third year, primarily between September and December, with a peak in October (NFMS 2007). Over most of this interval, mainstem flows below Iron Gate Dam often are high (ca. 2500-3000 cfs: NMFS 2001). Thus, standard methods for observing and counting spawning fish are not easily applied, and the size of the spawning population is unknown. Approximations put the entire ESU at about 10,000 spawning Coho salmon of non-hatchery origin per year (Weitkamp, *et al*. 1995), of which only a small portion is associated with the Klamath Basin, where several important tributary runs have been reduced to a handful of individuals (NMFS 2001, 2007). Although a minor amount of spawning and growth may occur in the mainstem, the mainstem serves adults primarily as a migration route (NFMS 2007).

Spawning occurs from November to January (Hassler 1987) in the tributaries to the Klamath River, but occasionally as late as February or March (Weitkamp, *et al*. 1995). Coho salmon eggs incubate for 35-50 days between November and March. Successful incubation depends on several factors including dissolved oxygen levels, temperature, substrate size, amount of fine sediment, and water velocity. Fry start emerging from the gravel two to three weeks after hatching and move into shallow areas with vegetative or other cover. As fry grow larger, they disperse up or downstream. In summer, Coho salmon fry prefer pools or other slower velocity areas such as alcoves, with woody debris or overhanging vegetation. Juvenile Coho salmon over-winter in slow water habitat with cover as well. Juveniles may rear in fresh water for up to 15 months then migrate to the ocean as smolts from March to June (Weitkamp, *et al.* 1995). Coho salmon adults typically spend two years in the ocean before returning to their natal streams to spawn as three-year olds.

Available historical and most recent published Coho salmon abundance information are summarized in the NOAA-Fisheries coast-wide status review (Weitkamp, *et al*. 1995). The rivers and tributaries in the California portion of this ESU were estimated to have average recent runs of 7,080 natural spawners and 17,156 hatchery returns, with 4,480 identified as native fish occurring in tributaries having little history of supplementation with non-native fish. However, limited information exists regarding Coho salmon abundance in the Klamath River basin. What information exists [CDFW unpublished data; U.S. Fish and Wildlife Service (USFWS) unpublished data] suggests adult populations are small to nonexistent in most years. The decline of SONCC Coho salmon across the ESU is not the result of one single factor, but rather a number of natural and anthropogenic factors that include dam construction, instream flow alterations; land use activities coupled with large flood events, fish harvest and hatchery effects.

Garwood, J. 2012. Historic and recent occurrence of Coho salmon (*Oncorhynchus kisutch*) in California streams within the Southern Oregon/Northern California Evolutionarily Significant Unit. Fisheries Branch Administrative Report, 2012-03. California Department Fish and Wildlife, Arcata, CA. 77 p.

Salmon River Restoration Council (SRRC). 2005. Salmon River Coho salmon presence/absence and refugia use assessment summary. Unpub. data.

Chinook Salmon

The following information was excerpted or summarized from NMFS status review of Chinook salmon (Meyers, *et al.* 1998). Chinook salmon mature between 2 and 6+ years of age (Meyers, *et al.* 1998). Fall-run Chinook salmon enter freshwater at an advanced stage of maturity, move rapidly to their spawning areas on the mainstem or lower tributaries of the rivers, and spawn within a few days or weeks of freshwater entry (Healey 1991). Incubation temperature for eggs is 5.0 to 14.4°C, with below 13.0°C preferred for optimal development in most stocks (McCullough 1999). Emerging fry generally do not develop normally above 12.8°C (McCullough 1999). Post-emergent fry seek out shallow, nearshore areas with slow current and good cover, and begin feeding on small terrestrial and aquatic insects and aquatic crustaceans. Once feeding, the optimal growth range for juveniles is 10.0 to 15.6°C, with fingerlings preferring to hold at 12 to 14°C (McCullough 1999). In preparation for their entry into a saline environment, juvenile salmon undergo physiological transformations known as smoltification that adapt them for their transition to salt water. For Chinook salmon, the recommended maximum temperature to maintain migratory response and seaward adaptation is 12.0°C; and at temperatures greater than 13.0°C, some physiological processes of smolting may be delayed, and, in extreme cases, reversed (McCullough 1999). Chinook salmon spend between one and four years in the ocean before returning to their natal streams to spawn (Meyers, *et al*. 1998). Chinook salmon addressed in this document exhibit an ocean-type life history, and smolts out-migrate predominantly as subyearlings, generally during April through July. Chinook salmon spend between 2 and 5 years in the ocean (Healey 1991), before returning to freshwater to spawn. Some Chinook salmon return from the ocean to spawn one or more years before full-sized adults return.

The UKT ESU includes fall- and spring-run Chinook salmon in the Klamath and Trinity River Basin upstream of the confluence of the Klamath and Trinity rivers. Historically, spring-run Chinook salmon were probably the predominate run. This ESU still retains several distinct spring-run populations, albeit at much reduced abundance levels. Fish from this ESU exhibit an ocean-type life history; however genetically and physically, these fish are quite distinct from coastal and Central Valley Chinook salmon ESUs. Genetic analysis indicated that this ESU form a unique group that is quite distinctive compared to neighboring ESUs. The majority of spring- and fall-run fish emigrate to the marine environment primarily as subyearlings, but have a significant proportion of yearling smolts. Recoveries of coded wire tags indicate that both runs have a coastal distribution off the California and Oregon coasts. The 2011 fall-run Chinook salmon run into the Klamath River system, as compiled by CDFW, was estimated to be 188,845 fish (103,005 adult and 85,840 grilse) (CDFW 2012). This is 154% of the 1978-2011 mean run total of 122,510 fish. Of the 110,554 basin-wide natural spawners (i.e., not of hatchery origin), 5,493 were from the Salmon River and 5,515 from the Scott River. The Klamath River run in 2013 was projected to be above recent historical average (KRTT 2013).

North Fork Salmon River – Chinook Surveys

Chinook are present in the NF Salmon River, inclusive the Project area (~River Mile 4 to Mile 16).

Spawning surveys targeting Chinook have occurred on the NF Salmon River in the Project area since 1980, with fish and/or redds reported most years. Focus has primarily been on the fall-run, although some surveys have happened early enough (September through early-October) to

captured spring-run Chinook. Also, spring Chinook are routinely reported during the annual spring Chinook/summer steelhead dive event (late-July or early-August) since 1990.

A 2005 survey of thermal refugia of the NF Salmon River found Chinook juveniles at the mouth of the following tributaries between Forks of Salmon and Jackass Gulch (downstream to upstream): Big Creek, Olsen Gulch, Jones Gulch, Cronan Gulch, Little North Fork Salmon River, Shiltos Creek, and Jackass Gulch (SRRC 2005).
*Location restricted to general Project area (River Mile 4 to Mile 16)
*Query performed on 2/3/2014

- See project record for expanded datasets referred in summary
- Chinook distribution maps include the NF Salmon River in the Project area

Live/Dead Fish Count

- CalFish records available (8): 91145, 91170, 91518, 91519, 91522, 91523, 91526, 91527
    - Inclusive years (all datasets): 1980-1985, 1988, 1989, 1990-2005
- Summary: Chinook recorded in all years, except 1983 and 1984 (no surveys)

Redd Count

- CalFish records available (1): 91073
    - Inclusive years (all datasets): 1971, 1972, 1978, 1980, 1981, 1983-1994
- Summary: Redds recorded all years

Unpublished data and/or field notes from: 1985-2013

Salmon River Restoration Council (SRRC). 2005. Salmon River Coho salmon presence/absence and refugia use assessment summary. Unpub. data.

Steelhead

Biologically, steelhead can be divided into two basic run-types, based on the state of sexual maturity at the time of river entry and duration of spawning migration (Moyle 2002). The stream-maturing type, or summer steelhead, enters fresh water in a sexually immature condition and requires several months in freshwater to mature and spawn. The ocean-maturing type, or winter steelhead, enters fresh water with well-developed gonads and spawns shortly after river entry (August 9, 1996, 61 FR 41542; Barnhart 1986). South of Cape Blanco, Oregon, summer steelhead are known to occur in the Rogue, Smith, Klamath, Trinity, Mad, and Eel rivers, and in Redwood Creek (Busby, *et al.* 1996).

Winter steelhead in California enter fresh water after rivers rise in response to fall/winter rains, typically from December through March, with a peak in January and February, with spawning soon after reaching the breeding grounds (Moyle 2002). In contrast, summer steelhead enter systems as flows taper off in the spring, then spawn the following winter (Moyle 2002). Steelhead require a minimum depth of 0.18 m and a maximum velocity of 2.44 m/s for active upstream migration (Smith 1973). Spawning and initial rearing of juvenile steelhead generally take place in small, moderate-gradient (generally 3-5%) tributary streams (Nickelson, *et al*. 1992). A minimum depth of 0.18 m, water velocity of 0.30-0.91 m/s, and clean substrate 0.6-10.2 cm (Nickelson, *et al*. 1992) are required for spawning. Steelhead spawn in 3.9-9.4°C water (Bell 1991). Depending on water temperature, steelhead eggs may incubate for 1.5 to 4 months (August 9, 1996, 61 FR 41542) before hatching, generally between February and June (Bell 1991). After two to three weeks, in late spring, and following yolk sac absorption, alevins emerge from the gravel and begin actively feeding. After emerging from the gravel, fry usually inhabit shallow water along banks of perennial streams. Fry occupy stream margins (Nickelson, *et al*. 1992). Summer rearing takes place primarily in the faster parts of pools, although young-of-the-year are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small wood. Some older juveniles move downstream to rear in larger tributaries and mainstem rivers (Nickelson, *et al*. 1992). Steelhead prefer water temperatures

ranging from 12-15°C (Reeves *et al*. 1987). Juveniles live in freshwater from one to four years (usually two years in the California ESUs), then smolt and migrate to the ocean in March and April (Barnhart 1986). Winter steelhead populations generally smolt after two years in fresh water (Busby, *et al*. 1996).

The KMP steelhead ESU occurs in coastal river basins between the Elk River in Oregon and the Klamath River in California, inclusive. The KMP steelhead ESU contains populations of both winter and summer steelhead. The Rogue and Klamath River basins are distinctive in that they are two of the few basins producing "half-pounder" steelhead. In 2001, NOAA-Fisheries reconsidered the status of KMP steelhead under the ESA (66 FR 17845, April 4, 2001) and determined that KMP steelhead do not warrant listing as threatened or endangered at this time.

In California, the largest proportions of naturally spawning hatchery fish are believed to occur in the Trinity River, where estimates from 1990s range from 20-70 percent hatchery. These estimates apply to fall-run fish. Because the hatchery program in the Trinity River basin propagates mostly fall-run fish, natural spawners in this basin that return at other times are believed to be predominantly of natural origin. Counts at Willow Creek weir provide an estimate of about 2000 natural origin fall-run spawners per year. The Willow Creek weir samples steelhead only over a period of about 3 months during the fall run and thus provides no information about other runs in the basin. CDFW biologists estimated natural escapement in the California portion of the ESU to be approximately 30,000-50,000 adults per year.

CH for Coho Salmon (and) EFH for Coho/Chinook Salmon

Designated CH (CH) for Coho salmon encompasses accessible reaches of all rivers (including estuarine areas and tributaries) between the Mattole River in California and the Elk River in Oregon, inclusive (May 5, 1999, 64 FR 24049). The area described in the final rule represented the current freshwater and estuarine range of Coho salmon. Land ownership patterns within the Coho salmon ESU analyzed in this document and spanning southern Oregon and northern California are 53% private lands; 36% Federal lands; 10% State and local lands; and 1% Tribal lands. The Forest Service manages about 1,680,000 acres (90.6%) of land within the Forest boundaries and about 200,000 acres (9.4%) of land are within the Forest boundaries but in other ownership (LRMP, Page 3-12). EFH (EFH) is considered for both Coho and Chinook salmon, with consultation occurring under 305 (b) (4) (A) of the Magnuson-Stevens Fishery Conservation and Management Act. The definition of Coho/Chinook EFH components and extent is described by Amendment 14 (Appendix A, pages 12-35 [adopted year 2000]) of the 1978 Pacific Fisheries Management Council Salmon Fisheries Management Plan.

Conclusions regarding CH and EFH occurrence are based on field review of habitat suitability, professional judgment, District fish survey records, and California Department of Fish and Wildlife (CDFW) information. In general, the KNF Coho Presence (GIS) layer defines CH, and Coho or Chinook distribution (whichever is of maximal extent) defines EFH. As appropriate, the California state information in Calfish.org may also be utilized. Where information on Coho or Chinook is lacking (e.g., no/few surveys have been completed), else it is the professional judgment of the Fish Biologist that neither KNF nor Calfish.org range maps fully capture CH/EFH extent, the KNF Steelhead Trout Distribution (GIS) layer may be used as a proxy for maximum range of anadromous fishes. This dataset is recognized as a conservative approach for assessment of effects to anadromous fish habitat because Coho and Chinook salmon may not occupy the same waters as steelhead due to differences in jumping abilities. The maximum jumping height (under ideal conditions) for Coho is 2.2 meters; Chinook salmon is 2.4 meters; and steelhead is 3.4 meters (Meehan 1991). Therefore, steelhead trout can access more habitat than Coho or Chinook salmon (i.e., steelhead trout can make a 3-meter jump to migrate up a stream, but Coho and Chinook salmon cannot.). Additionally, differences in spawn timing may also affect actual distribution. As an example, steelhead spawn in the spring, encountering higher discharge conditions than Chinook, which spawn in the fall. In consequence, Chinook may be denied access to streams, or segments thereof, due to the presence of low-water barriers that are passible to steelhead during spring flows.

In all cases, field review and site-specific surveys may refine the location of CH or EFH.

Map A-X shows the distribution of CH and EFH the Action Area and Analysis Area. This map is based on fish distribution with site-specific changes made per professional fisheries biologist knowledge, stream surveys, or CDFW data. Although Field review, survey history, and CalFish.org generally agree concerning known Coho and Chinook presence in the Project area, lack of survey data means the existing range maps may not fully capture actual extent within the NF Salmon River tributaries.

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Appendix G: Summary of Project Element Effects to Coho Salmon, and Critical Habitat, by 2014 Fire Area

Beaver Fire

Beaver-Project element	Direct Effects to Coho Salmon	Indirect and Cumulative Effects to Coho Salmon and Critical Habitat			
		Sediment	**Water Quality**	**Riparian Function**	**Beneficial Effects**
Salvage and Reforestation 350 acres salvage; 1,782 acres site prep and plant	No effect	Minor effects due to small acreage treated; effects would add to elevated sediment conditions in Beaver, Doggett, and Kohl creeks which are heavily disturbed due to 2014 fires and private timber harvest (green and salvage)	Minor effects due to small acreage treated; insignificant effects due to project design	No effect because none is proposed in RR	Reduction of heavy fuels and planting will allow for quicker recovery of late seral vegetation on acres treated and the likely severity of future fires impacts are reduced, especially when fires occur greater than 5 years into the future
Fuels Reduction	No effect	Minor and insignificant due to low level of ground disturbance involved and project design	Minor and insignificant effects due to project design	Minor and insignificant due to project design	Reducing accumulations of dead and live fuels will mimic and promote the natural role of fire in the ecosystem
Hazard Tree Removal	No effect	Minor and insignificant effects due to project design	Minor and insignificant effects due to project design	Approximately 7 miles along CH would be affected; Minor and insignificant effects due to project design	None
Roads, Landings, and Water Drafting	Roads and Landings: no effect Water Drafting: minor short term effects related to disturbance; project design feature that requires coordination with KNF fisheries biologists when determining where water drafting will occur is critical to avoiding adverse effects to salmonids relying upon thermal refugia during base flows	Roads: no temporary road stream crossings, only 1.2 miles of road on existing roadbed outside of RR Landings: no new landings in RR Water Drafting: insignificant effects due to project design			None
Legacy Sediment Sites	No effect (none treated)				

Happy Camp Fire

Happy Camp-Project element	Direct Effects to Coho Salmon	Indirect and Cumulative Effects to Coho Salmon and Critical Habitat			
		Sediment	**Water Quality**	**Riparian Function**	**Beneficial Effects**
Salvage and Reforestation 8,728 acres salvage; 5,437 acres site prep and plant	No effect	Minor and insignificant effects due to project design	Minor and insignificant effects due to project design	No effect because none is proposed in RR	Lop and scatter hand treatments in RR would benefit 1,100 acres; Reduction of heavy fuels and planting will allow for quicker recovery of late seral vegetation on acres treated and the likely severity of future fires impacts are reduced, especially when fires occur greater than 5 years into the future
Fuels Reduction	No effect	Minor and insignificant effects due to low level of ground disturbance involved and project design	Minor and insignificant effects due to project design	Minor and insignificant effects due to project design	Reducing accumulations of dead and live fuels will mimic and promote the natural role of fire in the ecosystem
Hazard Tree Removal	No effect	Minor and insignificant effects due to project design	Minor and insignificant effects due to project design	Approximately 13 miles along CH would be affected; Minor and insignificant effects due to project design	None

Happy	Direct	Indirect and Cumulative Effects to Coho Salmon and Critical Habitat			
Roads, Landings, and Water Drafting	Roads and Landings: no effect Water Drafting: minor short term effects related to disturbance; project design feature that requires coordination with KNF fisheries biologists when determining where water drafting will occur is critical to avoiding adverse effects to salmonids relying upon thermal refugia during base flows	Roads: temporary road crossings would result in short term site level effects nine sites in tributaries above fish bearing habitat in Grider Creek, Cliff Valley Creek, and China Creek; effects to Critical Habitat would be insignificant; Landings: see riparian function; Water Drafting: insignificant effects due to project design	Minor and insignificant effects due to project design	Minor and insignificant effects due to project design; Landings: six new landings in RR were approved for use because potential risks to nearby aquatic habitat were minimized during project design so that meaningful effects to aquatic habitat are not likely; effects to Critical Habitat would be insignificant	None
Legacy Sediment Sites	No effect due to project design	All together these actions will result in meaningful beneficial effects in terms of aquatic organism passage (outside of Critical Habitat), habitat connectivity at crossings, and significant reduction in potential future sediment-related impacts from roads in Doolittle, Cougar, East Fork Elk, and mainstem Elk creeks. Approximately 17 miles of stream habitat, most within Critical Habitat, would benefit from these actions. The passage of aquatic organisms and watershed products down to Critical Habitat, would be improved in Malone, Twin, and Upper Elk creeks. Site level beneficial effects would also result from project use, and treatment of legacy sediment sites, on several temporary roads (46N41YA in lower Grider Creek, and temporary roads on existing roadbeds near the bottom of Kuntz and O'Neil creeks). These long term beneficial effects would occur on approximately 1.5 miles of stream habitat, above Critical Habitat, in Grider, Kuntz, and O'Neil creeks.			

Whites Fire

Whites-Project element	Direct Effects to Coho Salmon	Indirect and Cumulative Effects to Coho Salmon and Critical Habitat			
		Sediment	**Water Quality**	**Riparian Function**	**Beneficial Effects**
Salvage and Reforestation 741 acres salvage; 654 acres site prep and plant	No effect	Minor and insignificant effects due to project design	Minor and insignificant effects due to project design	No effect because none is proposed in RR	Lop and scatter hand treatments in RR would benefit about 127 acres; Reduction of heavy fuels and planting will allow for quicker recovery of late seral vegetation on acres treated and the likely severity of future fires impacts are reduced, especially when fires occur greater than 5 years into the future
Fuels Reduction	No effect	Minor and insignificant effects due to low level of ground disturbance involved and project design	Minor and insignificant effects due to project design	Minor and insignificant effects due to project design	Reducing accumulations of dead and live fuels will mimic and promote the natural role of fire in the ecosystem
Hazard Tree Removal	No effect	Minor and insignificant effects due to project design	Minor and insignificant effects due to project design	Approximately 8 miles along CH would be affected; Minor and insignificant effects due to project design	None
Roads, Landings, and Water Drafting	Roads and Landings: no effect Water Drafting: minor short term effects related to disturbance; project design feature that requires coordination with KNF fisheries biologists when determining where water drafting will occur is critical to avoiding adverse effects to salmonids relying upon thermal refugia during base flows	Roads: no temporary road stream crossings Landings: one new landing in RR was approved for use because potential risks to nearby aquatic habitat were minimized during project design so that meaningful effects to aquatic habitat are not likely; effects to Critical Habitat would be insignificant Water drafting: Minor and insignificant effects due to project design			None
Legacy Sediment Sites	No effect (none treated)				

Amendment to the Biological Assessment Submitted June 19, 2015

KNF – Westside Fire Recovery Project

Fisheries ESA consultation – Biological Assessment Addendum 6/19/15

This document summarizes how the Westside Fire Recovery Project (Project) action has evolved from what is proposed and analyzed in the 4/13/15 Biological Assessment (BA), received by NMFS on 4/16/2015. This document will also provide further clarification of several project design and effects analysis considerations contained in the original Project BA. As part of ongoing Project interdisciplinary team analysis, including consultation with USFWS and further economic and feasibility evaluations, there has been both a reduction in Project acreage to be included and an increase in resource protection measures since submittal of the original Project BA. Both singly, and cumulatively, these revisions reduce anticipated Project effects on SONCC Coho salmon and their CH when compared to effects anticipated from the Project as analyzed in the 4/13/15 BA. Changes will be discussed in the following categories:

1. Specific salvage and site prep and plant Project treatment units were deleted or reduced in size, including deletion of any associated temporary roads and landings;
2. Changes to specific project design features (increased protection measures);
3. Reduction in the extent of proposed roadside hazard tree removal and further restrictions on felling/removal and ground-based equipment in Riparian Reserves (RR);
4. Clarifications related to project design in Riparian Reserves (RR) and cumulative watershed effects modeling; and
5. Inclusion of a strategy for USFS/NMFS/Karuk cooperative Project monitoring.

Reduction in Project Unit Footprint

During further analysis as part of consultation with USFWS, some units (both salvage harvest units and site prep and plant units) were deleted from the Project, or reduced in size due to considerations related to Northern Spotted Owl. Also, some units were dropped due to economic and other feasibility considerations. Table 1 in the Fisheries BA displays the acres of salvage harvest and site prep and plant proposed. Below is an update of this table, showing where acreage is reduced in the updated consultation action. Relative to the Project Environmental Impact Statement (EIS), the consultation action analyzed in the 4/13/15 Fisheries BA is the same as Modified Alternative 2; this addendum updates the consultation action (referred to here as the updated consultation action) to make it the same as the action analyzed in the EIS as Modified Alternative 3. Based on these unit deletions and reductions in size, the total Project area subject to salvage harvest is now 5,627 acres.

Table 1. Updated Table 1 from 4/13/15 BA.

	Beaver Fire	Happy Camp Complex	Whites Fire	Grand Total
Site Prep and Plant	1,661	4,918	556	7,135
Logging System				
Ground-based	0	490	40	529
Skyline	0	3,200	210	3,409
Helicopter	0	2,519	438	2,956
Total	0	6,208	687	6,895
Watershed PDFs	Wet weather operations PDF-1; Skid trail and erosion control: PDFs 2, 7, 8, 10, 27, 28, 29, 30 and 32; Tractor harvest limitations: PDFs 3,4,7,9,12,14 and 26; Cable harvest limitations PDFs 3, 6 and 31.			
Total Acres of RRs within Harvest Units, which will be excluded from salvage harvest.	1,268			

Changes to Project Design Features

As part of completing an analysis to ensure Project consistency with the Forest Plan, several project design features (PDF) were refined to provide more protection to riparian and aquatic resources, including SONCC coho salmon and their designated critical habitat (CH). The updated PDFs are as follows (new text shown in *italics*): Watershed-4 (related to equipment in RR), Watershed-12 (related to hazard tree removal), and a Wildlife PDF that has been added to further restrict removal of live trees during roadside hazard operations. That new Wildlife PDF is: "*Trees without fire damage will not be felled unless they are an immediate hazard.*" Another PDF, Watershed-6, was updated to provide more information on geologic features in specific units. The three updated watershed PDFs are:

Updated Watershed-4

Tractors and mechanical harvesters will be excluded from all RR associated with stream channels, active landslides, inner gorges, and toe zones of dormant landslide deposits. *During roadside hazard tree removal actions within RR, ground based equipment will not leave the road.*

Updated Watershed-6

There will be no salvage logging on active landslides *or toe zones of dormant landslides except for units 5, 23, 32, 39, 55, 56, 57, 59, 64, 226, 268, 406, 520, 524, 525, and 530 which have been field reviewed by the Forest Geologist (see Geology amendment for details on criteria for exceptions).*

Updated Watershed-12

All hazard trees cut within 25 feet of a stream channel *or spring* will be left on site unless they continue to pose a threat to safety or accessibility (see Watershed-4 for equipment exclusion restrictions). *Along all stream channels (perennial and intermittent),* all hazard trees 26 inches diameter at breast height (dbh) or greater that are within the first site tree distance (150-170 feet) of any stream channel will be left on site unless after felling, they continue to pose a threat to safety, infrastructure, forest road drainage system integrity or

accessibility. *Any hazard tree (equal or greater than 26 inches dbh) below a road that would contact a fish bearing stream channel if felled that direction will be retained on site.*

Changes to Proposed Roadside Hazard

Additional field reconnaissance provided more information on where fire-killed roadside hazard trees would be removed. The Forest deleted from roadside hazard removal any areas that were not directly affected by the 2014 fires. Also, any roads that would need substantial work to again be drivable were dropped from hazard tree removal. As described above, a PDF was updated to prohibit equipment from leaving the road during roadside hazard removal within RR. Six maps covering the entire Project are included at the end of this document and display the reduced extent of roadside hazard in this updated consultation action.

Clarifications

During consultation, several topics were raised that the level 1 team believes may not have been sufficiently clear in the 4/13/15 Fisheries BA.

- Cumulative watershed effects modeling (CWE) output did not exclude RR acreage from salvage harvest treatment units (1,268 acres), which will, in fact, be avoided during all Project salvage harvest; therefore effects related to watershed disturbance are over-estimated in CWE modeling;
- Riparian Reserves associated with geologic features are included in the Project in the following manner:
    1) Stream course RR – no salvage harvest
    2) Inner gorge (not associated with annual scour stream channel) – no salvage harvest
    3) Active landslides – no salvage harvest*
    4) Toe zones of dormant slides – no salvage harvest*
    5) Severely weathered/highly dissected granitic lands where they do not overlap with numbers 1-4 above - yes, included for salvage

*There are several exceptions that were field approved for proposed salvage/replanting by the Project geologist, because they showed no indication of movement for at least 10 years and have vegetation conditions that would benefit from planting. These exceptions are generally small in size and many are road fill failures/slips which have been extensively mapped, especially in Walker Cr drainage; the largest is a toe zone area within helicopter Unit 32 which face drains to the Klamath River (see Table 2 below). All exceptions are skyline or helicopter, no ground based exceptions were considered.

Table 2. Exceptions listed in updated Watershed-6 PDF.

Fire area	7th field NAME	Unit #	Acres of Active LS or Toe Zone with Salvage and Planting
HC	Upper Grider Creek	520	0.04
HC		524	0.5
HC		525	0.5
HC	Cliff Valley Creek	226	0.4
HC	Lower Grider Creek	268	0.1

Fire area	7th field NAME	Unit #	Acres of Active LS or Toe Zone with Salvage and Planting
HC		56	1.0
HC		64	0.4
HC	Tom Martin Creek- Klamath River	32	18.0 17 of these acres are one toe zone
HC	O'Neil Creek	5	0.07
HC	Walker Creek	23	2.3
HC		55	3.6
HC		57	0.1
HC		59	1.6
HC	Tompkins Creek	530	1.1
HC	Franklin Gulch-Scott River	39	1.0
Whites	Music Creek	406	0.08

Added Strategy for Interagency and Tribal Project Monitoring

As part of the Project consultation, the Forest, NMFS, and Karuk Tribe jointly developed a strategy to monitor implementation of Project elements that have the greatest likelihood of impacting SONCC coho salmon and other salmonids. Pre Project, the group will monitor the hazard tree mark where it is proposed near SONCC coho salmon CH; during the Project (especially June-Sept) all parties will share information about where Project water drafting is occurring, jointly monitor those water drafting actions, and help Forest Service Representatives decide where to shift Project water drafting so that impacts to SONCC Coho salmon and its CH are not adverse; also during the Project, the Forest Service and NMFS level 1 team will coordinate in closer monitoring of the status of ground disturbing actions if/when operations are occurring outside of the Normal Operating Season (NOS) or within the NOS during wet weather - to ensure compliance with Forest Service Best Management Practices and Wet Weather Operations standards.

Hazard Tree Mark

As described in the BA, roadside hazard tree removal is proposed in relatively close proximity to SONCC Coho salmon CH along several reaches of the following streams:
Beaver Cr, Walker Cr, Grider Cr, China Cr, Little Horse Cr, East Fork Elk Cr, Cougar Cr, Tompkins Cr, North Russian Cr, North Fork Salmon River, and Whites Gulch.
Prior to implementation of roadside hazard tree removal, the hazard tree mark downslope of roads adjacent to these creeks will be checked by fisheries biologists working for Forest Service, NMFS, or Karuk Tribe.

- Beaver Cr – Forest Service review on 6/5/15 confirmed that there are no hazard trees in close proximity to Coho CH in Beaver Cr, including West Fork Beaver Cr. Forest Service timber staff confirmed that Project timber sales of hazard trees do not include trees along the mainstem and West Fork Beaver Cr;
- East Fork Elk Cr - Forest Service and NMFS level 1 team reviewed hazard tree marking on 6/9/15 and confirmed that trees in close proximity to Coho CH have been marked according to description;
- Tompkins Cr – Forest Service review on 6/12/15 confirmed that trees in close proximity to Coho CH have been marked according to description; and
- The remaining creeks listed will be checked for appropriate hazard tree marking by July 15.

Water Drafting

The Fisheries BA identifies all the water drafting locations within the most current KNF GIS layers, and project design features related to where, and the manner in which, water is drafted. As part of designating water drafting sites for timber sale operations, Forest Service fisheries biologists will be involved in the process in determining where water will be drafted. Especially during June through September, Forest Service fisheries biologists will coordinate with NMFS and Karuk fisheries biologists about where Project-related water drafting is occurring, and this water drafting will be monitored by fisheries biologists working for Forest Service, NMFS, or Karuk Tribe.

Wet Weather Operations Monitoring

Starting in the fall when wet weather is forecast, the Level 1 team will coordinate with timber sale administrators to track what ground disturbing actions are ongoing. At least once a month during the months outside of the NOS, the level 1 team will meet with timber staff and will schedule field visits to ongoing Project actions accordingly. These updates will identify where delayed or unfinished Project operations may pose erosion risks; and assess the likelihood that Project sediment mobilization and/or erosion impacts has exceeded, or is expected to exceed, wet weather operation standards. As described in wet weather operations standards, immediate action will be taken to hydrologically stabilize Project areas with erosion risks, to avoid or minimize sediment mobilization.

Reduction in Effects to SONCC Coho Salmon and CH

The proposed action includes five Project Elements:

- Salvage and Reforestation
- Fuels Reduction
- Hazard Tree Removal
- Temporary Roads, Landings and Water Drafting
- Legacy Site Treatments

Changes to the proposed action, as described above, result in a reduction of potential effects to SONCC Coho salmon and CH related to the following Project Elements: salvage and reforestation, temporary roads and landings, and hazard tree removal.

Salvage and Reforestation

Project units have been reduced by about 3,000 acres, distributed across the project area. The following table updates Table 2 of the Fish BA.

Table 3. Updated Table 2 of 4/13/15 Fisheries BA, showing proposed salvage acreage by watershed.

5th Field Watershed	Proposed Salvage Acres 4/13/15 BA	Proposed Salvage Acres Updated Action
Beaver Creek	129	0
Elk Creek	651	250
Horse Creek-Klamath River	221	0
Humbug Creek-Klamath River	0	0

5th Field Watershed	Proposed Salvage Acres 4/13/15 BA	Proposed Salvage Acres Updated Action
Lower Scott River	1619	636
Indian Creek	0	0
North Fork Salmon River	741	687
Seiad Creek-Klamath River	6107	5103
South Fork Salmon River	0	0
Thompson Creek-Klamath River	350	219
Ukonom Creek-Klamath River	0	0
Total	9,818 Approximately 1,990 acres of this total were within stream course RR and therefore excluded from salvage harvest	6,895 Approximately 1,268 acres of this total are within stream course RR and therefore excluded from salvage harvest

Updated Effects

The BA describes the expected effects from salvage and reforestation actions to sediment related habitat indicators (pgs. 40-46), water quality (pgs. 55-56), and riparian function including LWD (pgs. 60-62). The analysis concludes that these actions would have only minor and insignificant effects to SONCC Coho salmon and CH due to the exclusion of stream course RR and inner gorge areas and implementation of PDFs that sufficiently minimize disturbance outside of RR.

Figure 3 in the BA displays how inner gorges and other geologic features overlap Project units in lower Grider and Walker Creek. The figure below updates the original Figure 3 in the 4/13/15 Fisheries BA, and displays how the updated action units overlap these features.

The BA, pg. 40, states that "Stream course RR, as well as inner gorges and active landslides, are excluded from salvage harvest units." As described above, this addendum clarifies that there are several exceptions that were field reviewed and approved by the Forest Geologist because they are relatively small areas that show no indication of movement in at least 10 years and proposed salvage/reforestation would result in a net benefit to slope stability (updated Watershed-6 PDF). The Project Geology Report describes that there is expected to be no effect to slope stability from salvage harvest, even on these small areas of unstable lands listed as exceptions. The level 1 team reviewed the exceptions listed in Table 2 above and considered potential impacts to fish habitat (including SONCC Coho salmon CH). The largest area is a toe zone within helicopter Unit 32 located upslope of Highway 96 in a face drainage to the Klamath River, just downstream from where Kuntz Cr joins the Klamath River. As described in the Project Geology Report, the current landslide risk in this 7th field watershed is Moderate and the Forest Geologist expects there is low likelihood of landsliding associated with helicopter salvage harvest on the potentially unstable toe zone in Unit 32. Potential Project effects to slope stability, or landsliding risk, are related to the infrastructure needed for logging; these effects are summarized below under Temporary Roads and Landings and in more detail in the Project Geology Report. At the site scale there is a net benefit from salvage/reforestation on these areas of unstable lands because the removal of dead trees does not increase the risk of landslides and planting is likely to reduce the duration of elevated landsliding risk.

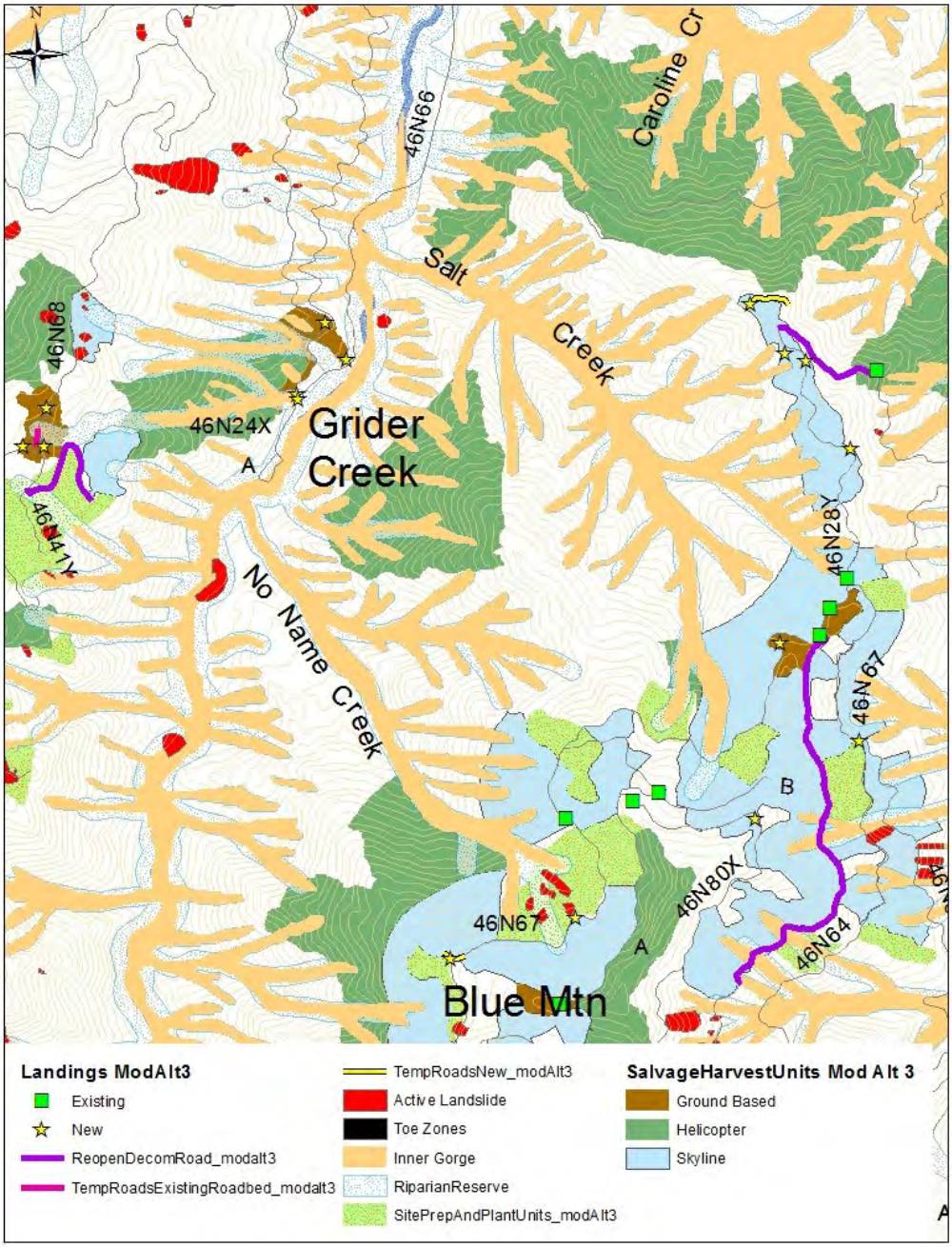


Figure 1. Updated Figure 3 of Fish BA.

Several areas in relatively close proximity to CH were dropped from salvage harvest in the following drainages: Little Elk Cr/EF Elk Cr, Grider Cr, and Walker Cr (Figure 2 displays where salvage is reduced in Grider and Walker Creek areas). All salvage harvest was dropped from Beaver and Horse Cr-Klamath River watersheds (Beaver Fire), and in Cougar Cr and Doolittle Cr drainages (Happy Camp Fire). Overall these changes reduce ground disturbance outside of RR and incrementally reduce cumulative watershed effects, but this reduction does not change the not likely to adversely affect (NLAA) determination of the Project on SONCC coho salmon and its designated CH.

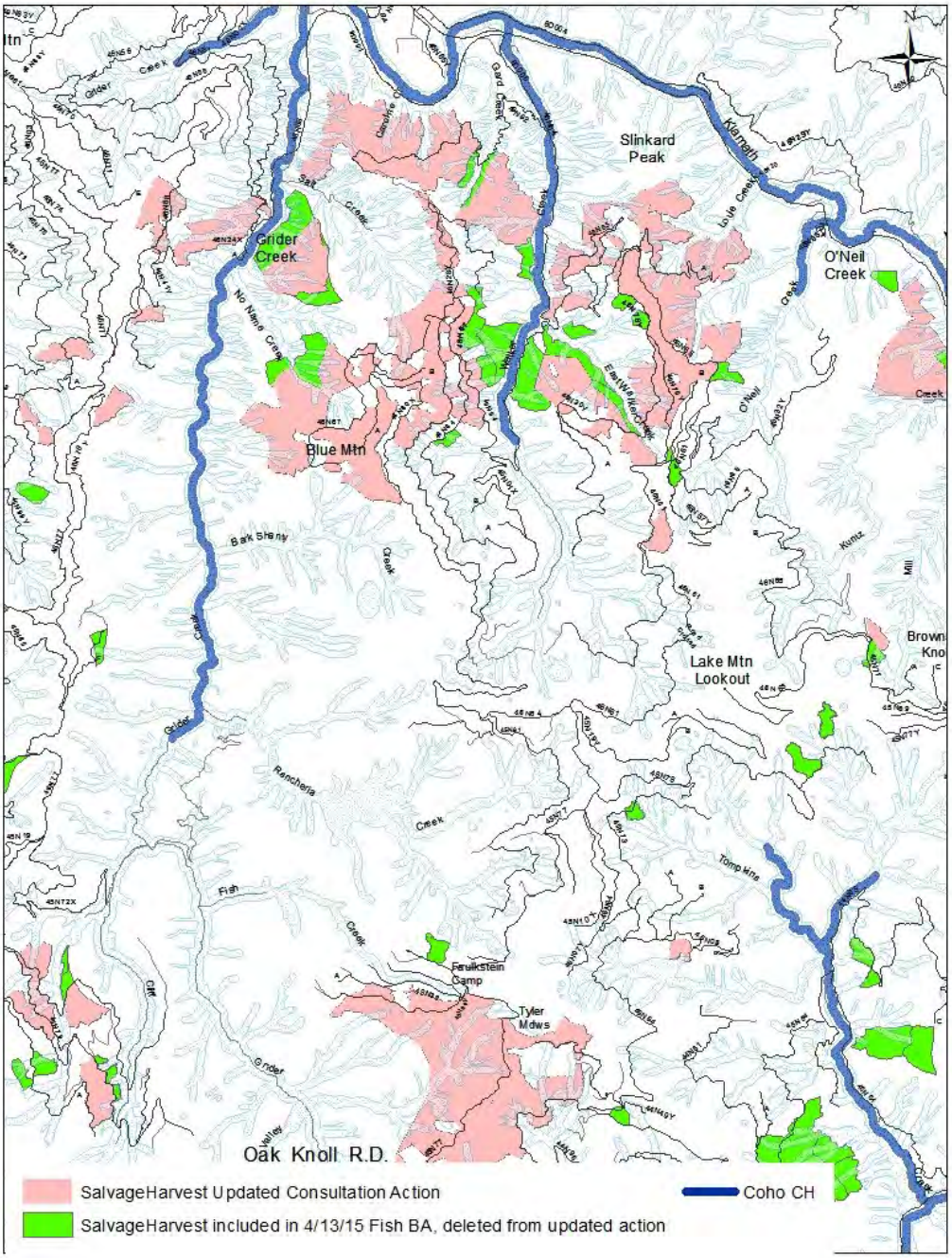


Figure 2. Proposed salvage harvest in the Grider and Walker Creek areas, showing the reduced area proposed in Updated Consultation Action. The green polygons have been deleted from the updated consultation action.

Temporary Roads and Landings

Implementation of the updated reduced action would involve less temporary roads and landings. Temporary road actions and landings that were removed from the Project, due to deletion of associated units, include several near- stream roads that were identified in Table 32 of the 4/13/15 Fisheries BA. The table below updates Table 32.

Table 4. Updated Table 32 from 4/13/15 BA, new text in italics.

Receiving Stream Name	Road Type	Confirmed Stream Type Crossing	Comments
Grider Creek	Decomm. Road 46N41YA	2 perennial	One crossing is legacy site; the Project will reduce sediment in the long term.
Walker Creek	Decomm. Road 46N63	No crossing	No stream crossing features; old road bed cut in bedrock. Several small road fill slips/slides occur below road bed, more effects information on this road below under Updated Effects.
Cliff Valley Creek	Decomm. Road 46N77	1 Intermittent	Stable, moderate risk
China Creek	Decomm. Road 46N78	5 Intermittent	Use of this road segment has been reduced, only the beginning 0.55 miles of the road will be used including one intermittent stream crossing. The 4/13/15 Fisheries BA analyzed use of 1.1 miles of this road with 5 intermittent or ephemeral channel crossings.Stable, low risk
Kuntz Creek	Existing Temporary Road	No crossing involved in road (except crossing of private diversion ditch)	Road has drainage problems; use of road is low risk; the Project will reduce sediment long term
O'Neil Creek	Existing Temporary Road	1 intermittent	This road segment will no longer be used for the Project.Road has drainage problems; intermittent channel captured by road prism; use of road is low risk; the Project will reduce sediment long term

Other temporary roads that did not involve near stream actions were dropped from the Project, along with many landings. All temporary roads and landings in the Beaver Fire were dropped. The following tables update Tables 7 and 8 from the BA and display the number of temporary roads and landings that remain in the updated consultation action.

Table 5. Updated BA Table 7, temporary road actions.

	Project Temporary Road Actions
Miles New Temp. Road	3.2
Miles Temp. Road Existing Alignment	4.6
Miles Reopened Decomm. Roads	4.8
Total Miles of Temporary RoadConstruction	12.7
# of Temp Road Stream Crossings	4
# of Temp Road Stream Crossings in anadromous salmonid habitat	0
Watershed PDFs	New temporary roads: PDFs 5, 23, 24 Watering roads: PDFS 18 Culvert replacements 20Water drafting 37, 38.

Table 6. Updated BA Table 8, temporary road miles by 5th field watershed.

5TH-FIELD	Reopen Decomm.Road	Temp. Roads on Existing Roadbed	Temp. Roads New	Total Miles
Beaver Creek	0	0	0	0
Elk Creek	0.2	0.7	0.2	1.1
Horse Creek-Klamath River	0	0	0	0
Humbug Creek-Klamath River	0	0	0	0
Indian Creek	0	0	0	0
Lower Scott River	0	0.8	0	1.1
North Fork Salmon River	0	0.6	0	0.6
Seiad Creek-Klamath River	4.0	1.8	2.9	8.7

5TH-FIELD	Reopen Decomm.Road	Temp. Roads on Existing Roadbed	Temp. Roads New	Total Miles
South Fork Salmon River	0	0.1	0.0	0.1
Thompson Creek-Klamath River	0.6	0.5	0	1.1
Ukonom Creek-Klamath River	0	0	0	0
Total Miles	4.8	4.6	3.2	12.7

The 4/13/15 Fisheries BA identified six new landings within RR that were approved for use by watershed specialists. None of these new landings in RR were dropped in the updated action. For the updated action, 95 landings were dropped. These landings are either existing landings in RR, or new/existing landings outside RR. The table below displays how landings are distributed across 5th field watersheds for the updated consultation action.

Table 7. Updated 4/13/15 Fisheries BA Table 9, types and numbers of Project landings, by 5th field watershed.

5th-field Watershed	Existing Landings	New Landings	Total
Ground Based Landing			
Beaver Creek	0	0	0
Horse Creek-Klamath River	0	0	0
Lower Scott River	3	3	6
North Fork Salmon River	0	1	1
Seiad-Creek-Klamath River	12	5	17
Thompson Creek-Klamath River	0	6	6
Total	15	15	30
Helicopter Landing			
Elk Creek	0	4	4
Lower Scott River	5	1	6
North Fork Salmon River	6	1	7
Seiad-Creek-Klamath River	14	28	42
Thompson Creek-Klamath River	0	0	0
Total	25	34	59
Skyline Landings			
Elk Creek	0	3	3
Lower Scott River	0	4	4
North Fork Salmon River	0	6	6
Seiad-Creek-Klamath River	0	10	10
South Fork Salmon River	0	0	0
Thompson Creek-Klamath River	0	3	3
Total	0	26	26
Total number of landings	40	75	115
New Landings in RRs	Landings # DZ03, DZ10, DZ23, L043, L044,and L090.		
Watershed PDFs	Use of existing landings: PDF 26 Expansion of landings: PDF 26 Erosion control on landings: PDF 26 Restoration of soil cover: PDF 26		

Updated Effects

The 4/13/15 Fisheries BA describes the expected effects of temporary road and landing actions to sediment related habitat indicators (pgs. 48-52), water quality (pgs. 57-58), and riparian function including LWD (pgs. 63-64).Reopening of decommissioned roads, use of temporary roads on existing roadbeds, construction of new temporary roads and the construction of new landings were considered high disturbance and incorporated into the 7th field scale landslide risk assessment in the Project Geology Report. There are two primary site scale effects of reopening decommissioned roads, use of temporary roads on existing roadbeds, construction of new temporary roads and the construction of new landings; these effects are described in the Project Geology Report and summarized here.The first effect is change to the hillslope mass balance such as undercutting and increasing the weight in unstable areas (spoil piles) from earthwork. Slope stability is most susceptible to the change in mass balance with new temporary road construction. There are no new temporary roads or landings being constructed on toe zones of dormant landslides, active landslides or inner gorges; only use of existing roadbeds will occur. Project design feature Watershed-20 restricts excess material from temporary roads, landings and other actions from being stored on active landslides (which include road fill failures/slips). This minimizes the potential for landslide re-activation due to increased weight. The second effect is the potential for poor drainage on the roads and landings which concentrates water onto hillslope which can, in turn, exacerbate existing unstable lands or create new landslides.The cessation of the use of temporary roads per the Wet Weather Operations (Project Design Feature Watershed- will minimize any rutting or tire tracks that can concentrate water on the road and hillslope. Project design feature Watershed-22 requires hydrologic stabilization of all temporary roads which includes control of the drainage on the roadbed. Project design feature Watershed-23 requires new landings to be configured for long- term drainage with the intention to (re)establish natural runoff patterns.

While PDFs minimize the effects to landslide risk, they do not eliminate them. The likelihood of a landslide at the site scale from temporary road actions and the construction of new landings will be increased. The increase will be highest during implementation of the project and will be reduced after the hydrologic stabilization has occurred at the completion of the Project. At the site scale, the landslide risk will remain above pre-project levels through the first winter after stabilization. Following the first winter they will likely be back to pre-project levels, or below in areas were legacy sites are being addressed on temporary road access. Temporary road actions were reviewed in the field to assess the presence of active features and potential consequences of landsliding to fish habitat. With the updated consultation action (and the action analyzed in 4/13/15 Fisheries BA), active features associated with proposed temporary road actions on existing road beds are primarily road fill failures/slips. As described above, re- opening these roads, using them, and then re-closing them increases the likelihood of further, or other, failures along the road prism as it re-adjusts. Table 4 above displays the temporary road actions most likely to have a noticeable influence on hillslope processes that translate to downhill fish habitat. The temporary road action remaining in the Project that may be most likely to experience fill failures or slides is the re-opening of decommissioned road 46N63 in Walker Cr drainage (visible in Figure 1 map above). Field review of this existing roadbed by the Forest Geologist found several fill failures/slides below the road which led to the conclusion that these fill slips, or other new slips along the roadbed, are likely when the roadbed is re-opened, used and re-adjusts after use and hydrologic stabilization. In consideration of the history of how this road adjusted during the 1997 flood event, its current condition and geology, and the distance to CH (about 1 mile downslope with another road in between), there is low likelihood that post-Project

slides/slips initiated from this roadbed would travel down to fisheries habitat or have any measurable effect to SONCC Coho salmon CH. The changes to temporary road actions reduce site scale short term negative effects to aquatic habitat disclosed in the BA (pgs. 49-51) only in the O'Neil Cr drainage; as described in the BA, use of this old roadbed would require fixing existing erosion-related problems which would have long term benefits to protection of water quality in this drainage. These potential long-term beneficial effects are to be foregone with the updated consultation action as these temporary road beds near the bottom of O'Neil Cr drainage will not be used and then appropriately hydrologically stabilized. They are to remain in their current condition and Project temporary road actions will have no effect to SONCC Coho salmon CH in O'Neil Creek. Other temporary roads dropped did not involve near stream actions and therefore the overall reduction in mileage of temporary road actions (from 16.4 miles to 12.7 miles) does reduce potential site-scale effects to hillslope processes including the sediment regime, but this reduction would not change the NLAA effect determination of the Project on SONCC coho salmon and its designated CH. The reduction in use of existing landings within RR, and reduction of new and existing landings outside of RR, results in less potential short term impact to watershed resources and fish habitat. However, this reduction in effects would not change the NLAA effect determination of the Project on SONCC coho salmon and its designated CH. Roadside Hazard Tree Removal Proposed roadside hazard tree removal has been changed in the following manner: Reduced extent – maps at the end of this document display where this action is reduced; increased retention of large wood – hazard trees 26 inches dbh and greater, within one site tree distance of all streams (intermittent and perennial), will not be removed; reduced ground disturbance – during implementation of roadside hazard tree removal in RR, equipment is prohibited from leaving the road; and increased retention of green trees – trees that were not affected by 2014 fires will not be felled unless they pose an immediate hazard. These changes result in reduced extent of potential impacts to SONCC Coho salmon and CH. As displayed in the following maps, areas dropped for roadside hazard removal include a few reaches in close proximity to CH. These include reaches of the Scott River and Klamath River as well as Kelsey, China, and Elk creeks. Other areas dropped that are in relatively close proximity to CH in an adjacent stream include Doolittle Cr, China Gul (NF Salmon), and Taylor Cr (NF Salmon). Table 8 below displays, by watershed, how many miles of CH are within 200 feet of roadside hazard roads, and the reduction in miles of CH potentially affected by roadside hazard analyzed in 4/13/15 BA relative to the updated action. Table 9 displays, by watershed, how many miles of intermittent and perennial stream total may be affected by proposed roadside hazard tree actions in the updated consultation action.

Table 8. Miles of Coho CH in close proximity to roadside hazard tree removal, showing where miles are reduced in the updated consultation action.

5th field Watershed	Miles of Coho CH within 200 feet of roadside hazard roads4/13/15 BA	Miles of Coho CH within 200 feet of roadside hazard roadsUpdated Consultation Action	Total CH miles in watershed
Humbug Creek - Klamath River	2.5	0	7.0
Beaver Creek	1.5	1.5	16.4
Horse Creek – Klamath River	0.3	0	26.4
Seiad Creek – Klamath River	2.9	1.3	38.5
Lower Scott River	3.6	1.0	26.7
Thompson Creek – Klamath River	1.1	0.6	13.7

5th field Watershed	Miles of Coho CH within 200 feet of roadside hazard roads4/13/15 BA	Miles of Coho CH within 200 feet of roadside hazard roadsUpdated Consultation Action	Total CH miles in watershed
Elk Creek	4.1	2.4	22.1
Uknonom Creek	0.2	0	8.4
North Fork Salmon River	5.7	5.2	32.3
TOTAL	22.0	12.0	191.5

Table 9. Miles of intermittent and perennial stream in close proximity to Project roadside hazard tree removal, Updated Consultation Action.

5th field watershed	Miles of perennial stream within 200 feet from roadside hazard tree removal roads	Miles of intermittent stream within 200 feet from roadside hazard tree removal roads	Total stream miles in watershed - intermittent and perennialPercentage of streams miles potentially affected by Project roadside hazard tree removal
Beaver Creek	3	4	2772.5%
Horse Creek-Klamath River	0	2	3220.6%
Seiad Creek-Klamath River	6	0	2052.9%
Lower Scott River	4	5	4761.9%
Thompson Creek-Klamath River	2	4	2972.0%
Elk Creek	5	4	3003.0%
North Fork Salmon River	11	5	6542.4%
TOTAL	31	24	2,5312.2%

Updated Effects

The BA describes the expected effects of roadside hazard tree removal to sediment related habitat indicators (pgs. 47-48), water quality (pg. 57), and riparian function including LWD (pgs. 62-63). As described in the BA, potential effects of roadside hazard tree removal are associated with soil disturbance, effects to stream shade, and removal of wood that provides various functions in the riparian zone (soil retention and productivity, and large wood loading to streams). The updated action reduces effects in each of these categories. Soil disturbance is reduced by restricting ground based equipment to roads when implementing hazard tree removal within RR. Potential effects to stream shade are reduced by restricting hazard trees targeted for removal to fire injured/killed trees. As described in the BA (pg. 57), potential effects to stream shade are associated with the removal of green hazard trees. The updated action restricts the felling of green hazard trees unless they are deemed to be an immediate hazard which will almost eliminate the felling/removal of live trees in the Project. This reduces the level of potential effect this action may have on stream shade across the reduced area it is now proposed.Effects related to loss of wood from riparian areas are reduced by extending the retention of all hazard trees 26 inches dbh and greater when they are within one site tree distance of all streams (the action analyzed in the 4/13/15 Fisheries BA retained these trees only adjacent to fish-bearing streams). In this manner, the project now ensures that any larger hazard trees that must be felled within stream LWD recruitment zones will be retained. Removal of hazard trees less than 26 inches dbh within stream LWD recruitment zones is included in order to address fuels-related

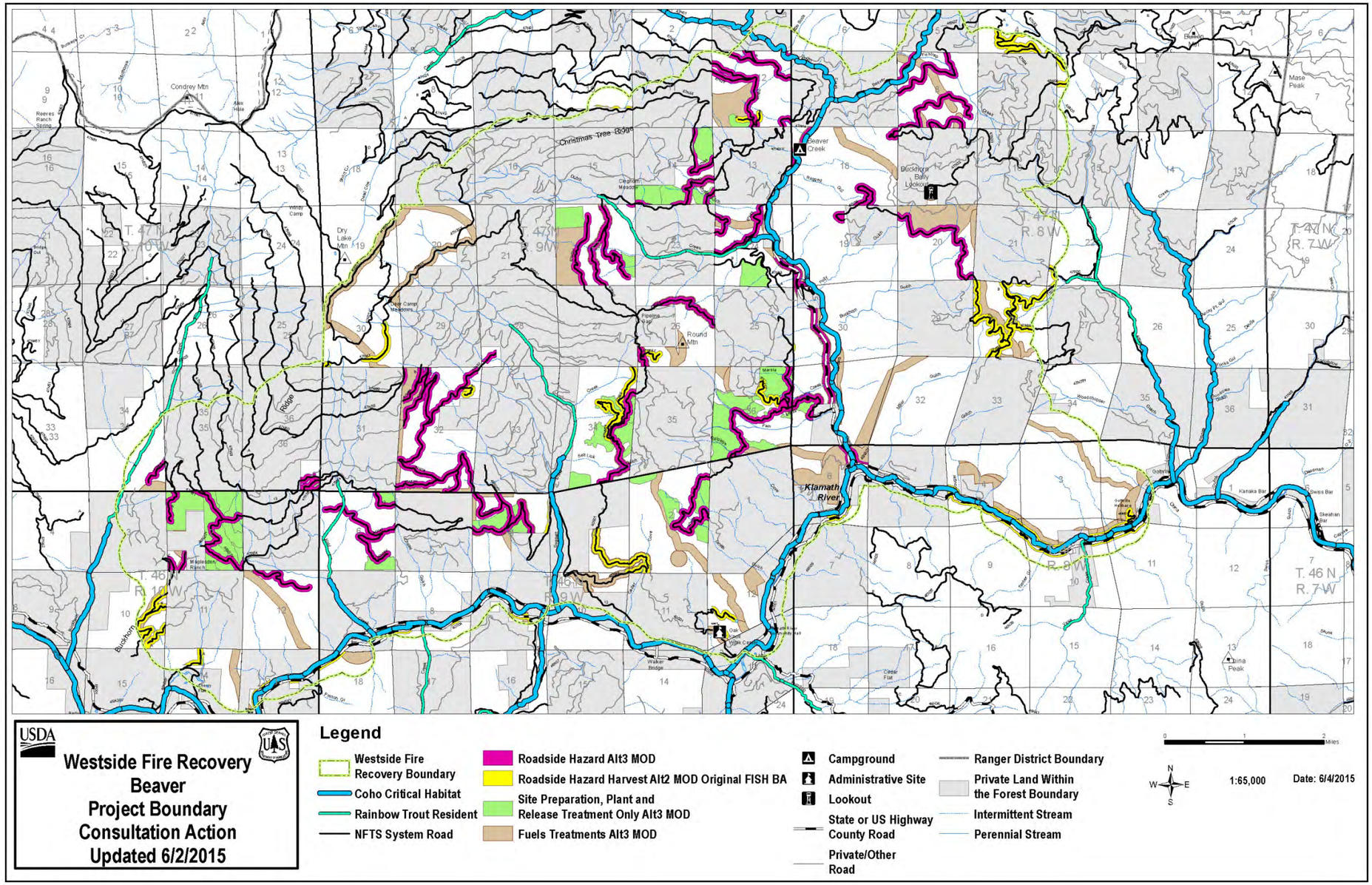
considerations summarized below. Also related to fuels, the removal of hazard trees is included within the outer portions of Riparian Reserve (generally outside of stream LWD recruitment zones); fish- bearing streams have Riparian Reserve that is two site trees wide on both sides of the stream, the outer portion refers to the area farther than one site tree from a stream.As part of Project planning and effects analysis, biologists and fuels specialists worked to find consensus on what fuels reduction actions are needed in Riparian Reserve in order to manage these areas within their historical range of variability. The team relied upon Forest Plan direction, historic information including fire history, field review, and best available information including scientific literature. Research specific to fire regimes and forest management in the Klamath Mountains are particularly relevant, including Skinner, 1997; Taylor and Skinner, 1998; and Skinner, 2003. In order to manage riparian areas within their natural range of variability, the historical fire regime must be an important and explicit consideration (Skinner 1997). As described in the literature, the Mediterranean climate of the Klamath Mountains is characterized by pronounced annual drought (independent of any prolonged drought). Even Riparian Reserves in the Klamath Mountains regularly experience conditions where fires can easily ignite and spread. Field review of existing conditions in the project area further reinforced for biologists the need to propose fuels and site preparation treatments in Riparian Reserves, and that removal of hazard trees 14-26 inches dbh within Riparian Reserves is consistent with LWD objectives and appropriate management to maintain and restore riparian function within the natural range of variability. Field review also included evaluation of potential effects of proposed hazard tree removal in the outer Riparian Reserve (farther than one site tree distance from fish-bearing streams). In consideration of both the historic fire regime (frequent mixed severity fire) and the current fire regime which is a product of mostly effective suppression then high severity fire, allowing hazard tree removal in these outer portions of the Riparian Reserve is likely to provide for more effective fuels management and decrease the probability that future high severity fire would reach near stream areas. For these reasons, and considering the relatively minor amount of near stream habitat that would be exposed to effects of these actions (Table 9), proposed hazard tree removal would have only discountable effects to large wood recruitment. The reduction in extent, and increase in protection measures for proposed roadside hazard tree removal results in less potential effects to SONCC Coho salmon CH. This reduction in effect is not expected to change the NLAA effect determination of the Project on SONCC coho salmon and its designated CH.Conclusions The updated consultation action is expected to result in less potential effects to SONCC Coho salmon and its designated CH as described above. The effects determination remains that this action May Affect, and is Not Likely to Adversely Affect Coho Salmon and CH.

Literature Cited

Skinner, C.N., 2003. A tree-ring based fire history of Riparian Reserves in the Klamath Mountains. In: Faber, P.M (ed.) 2003. California Riparian Systems: processes and floodplain management, ecology, and restoration. 2001 Riparian Habitat and Floodplains Conference Proceedings, Riparian Habitat Joint Venture, Sacramento, CA.

Skinner, C.N. 1997. Toward an understanding of fire history information. Pages 15-22 in: S. Sommarstrom (Editor). Proceedings of the Sixth Biennial Watershed Management Conference; October 23-25, 1996; Lake Tahoe, California/Nevada. Water Resources Center Report No. 92. Davis, CA. Centers for Water and Wildland Resources, University of California.

Taylor, A.H., C.N. Skinner, 1998. Fire history and landscape dynamics in a late-successional reserve, Klamath Mountains, California, USA. Forest Ecology and Management 111: 285-301.



Map H-8:Map of Beaver Fire area submitted with the Fisheries BA (July 2, 2015)

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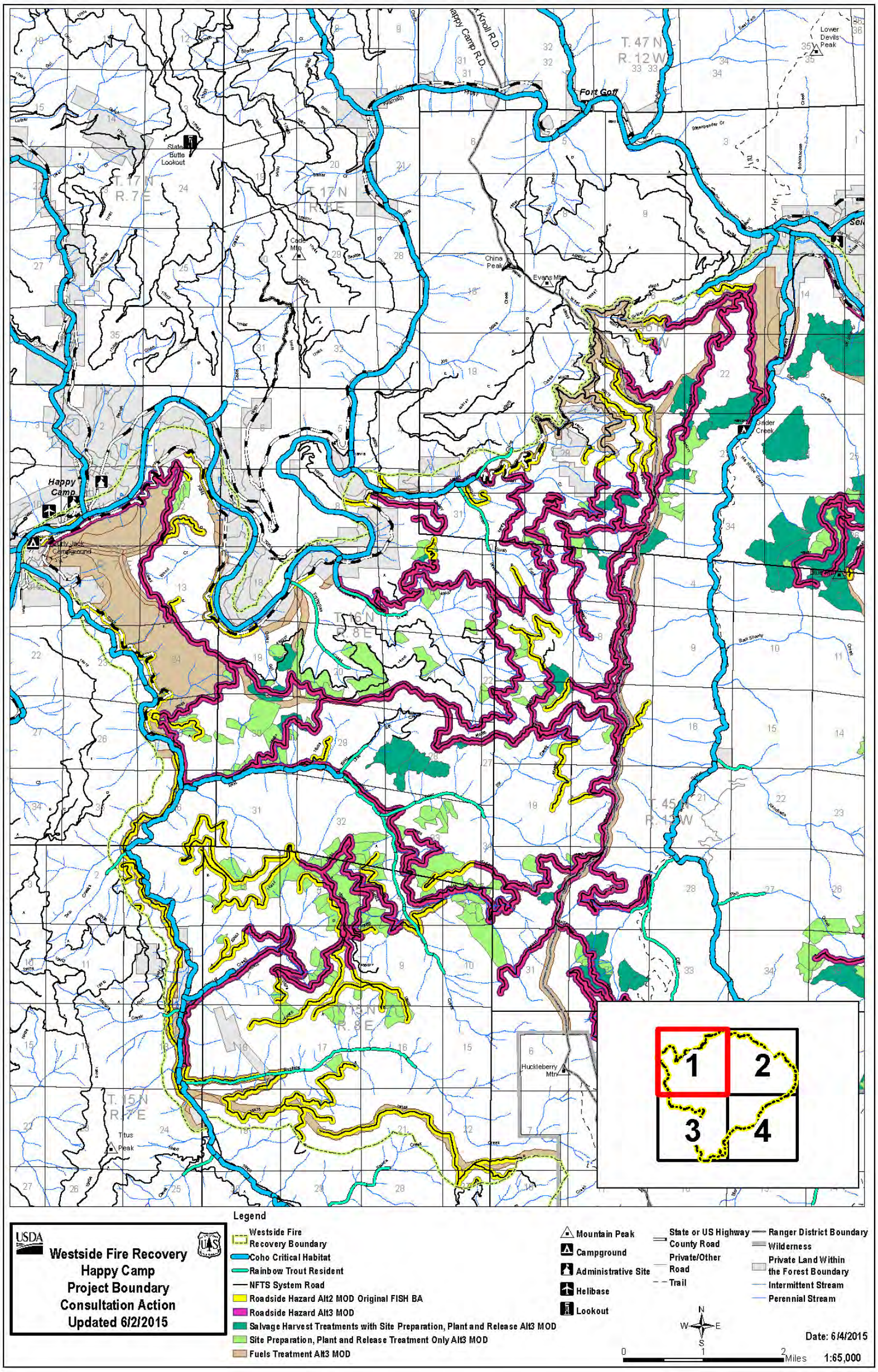

Map H-9: Map of Happy Camp Fire area (northwest section) submitted with the Fisheries BA (July 2, 2015)

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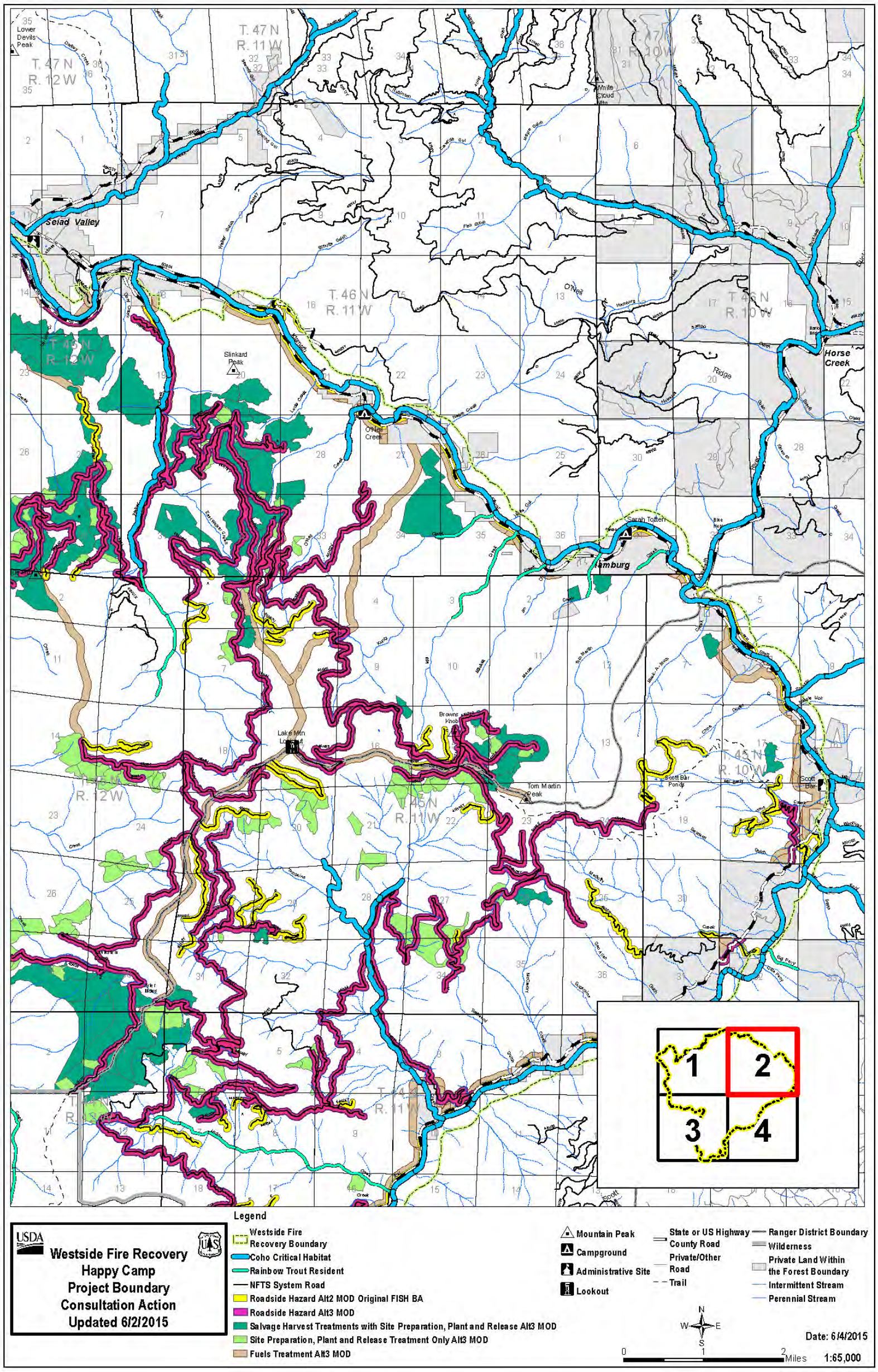

Map H-10: Map of Happy Camp Fire area (northeast section) submitted with the Fisheries BA (July 2, 2015)

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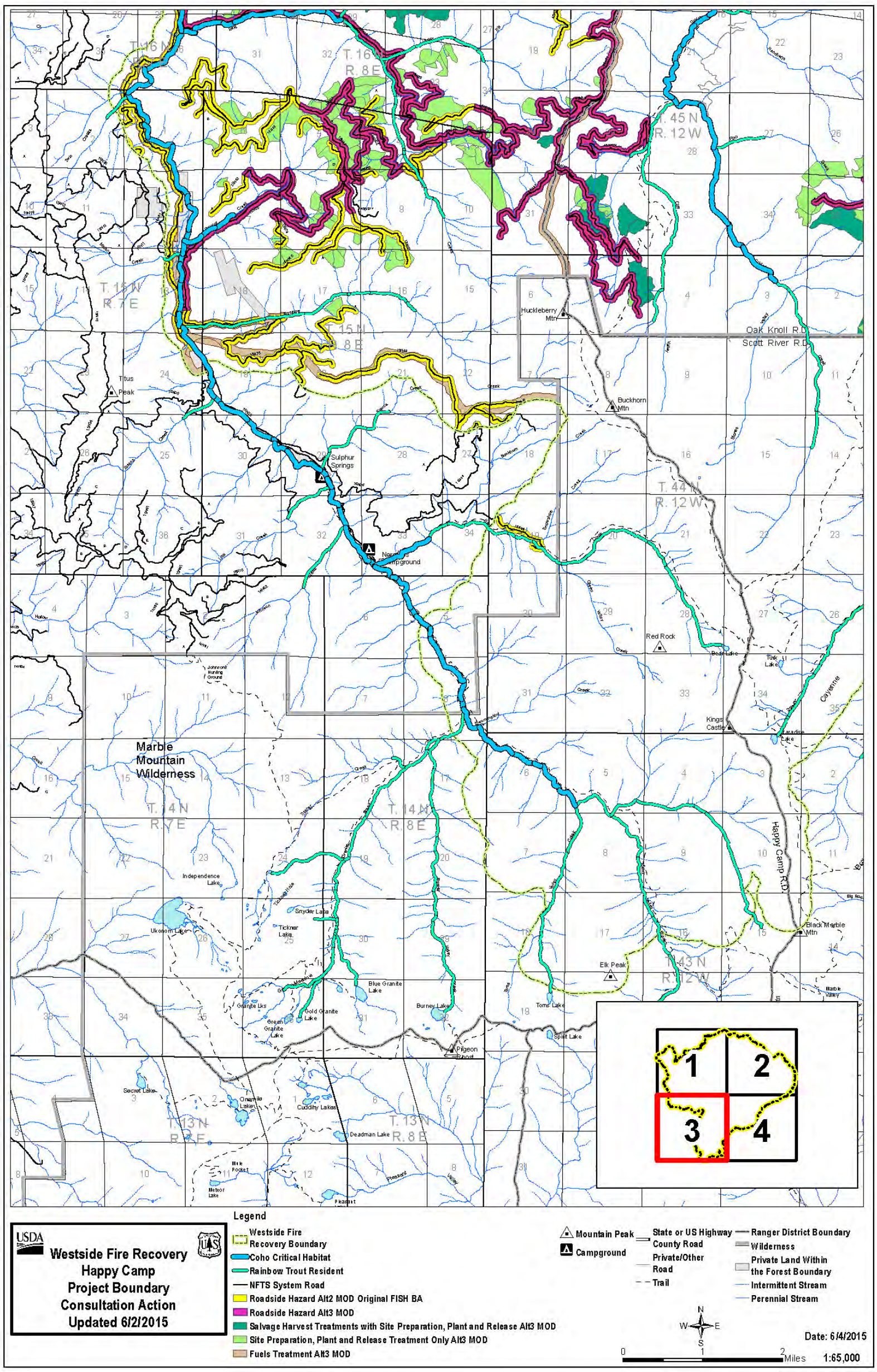

Map H-11: Map of Happy Camp Fire area (southwest section) submitted with the Fisheries BA (July 2, 2015)

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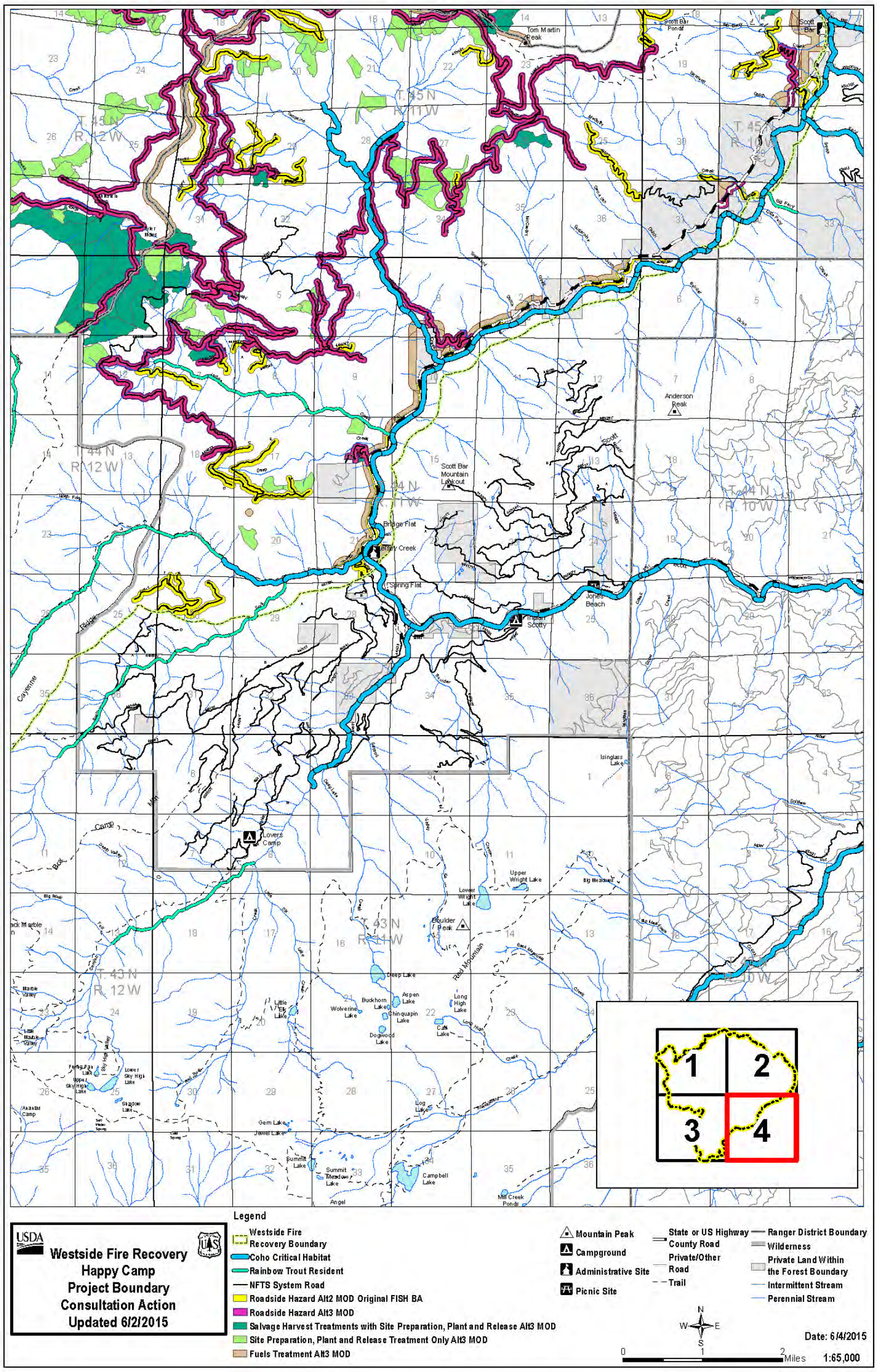

Map H-12: Map of Happy Camp Fire area (southeast section) submitted with the Fisheries BA (July 2, 2015)

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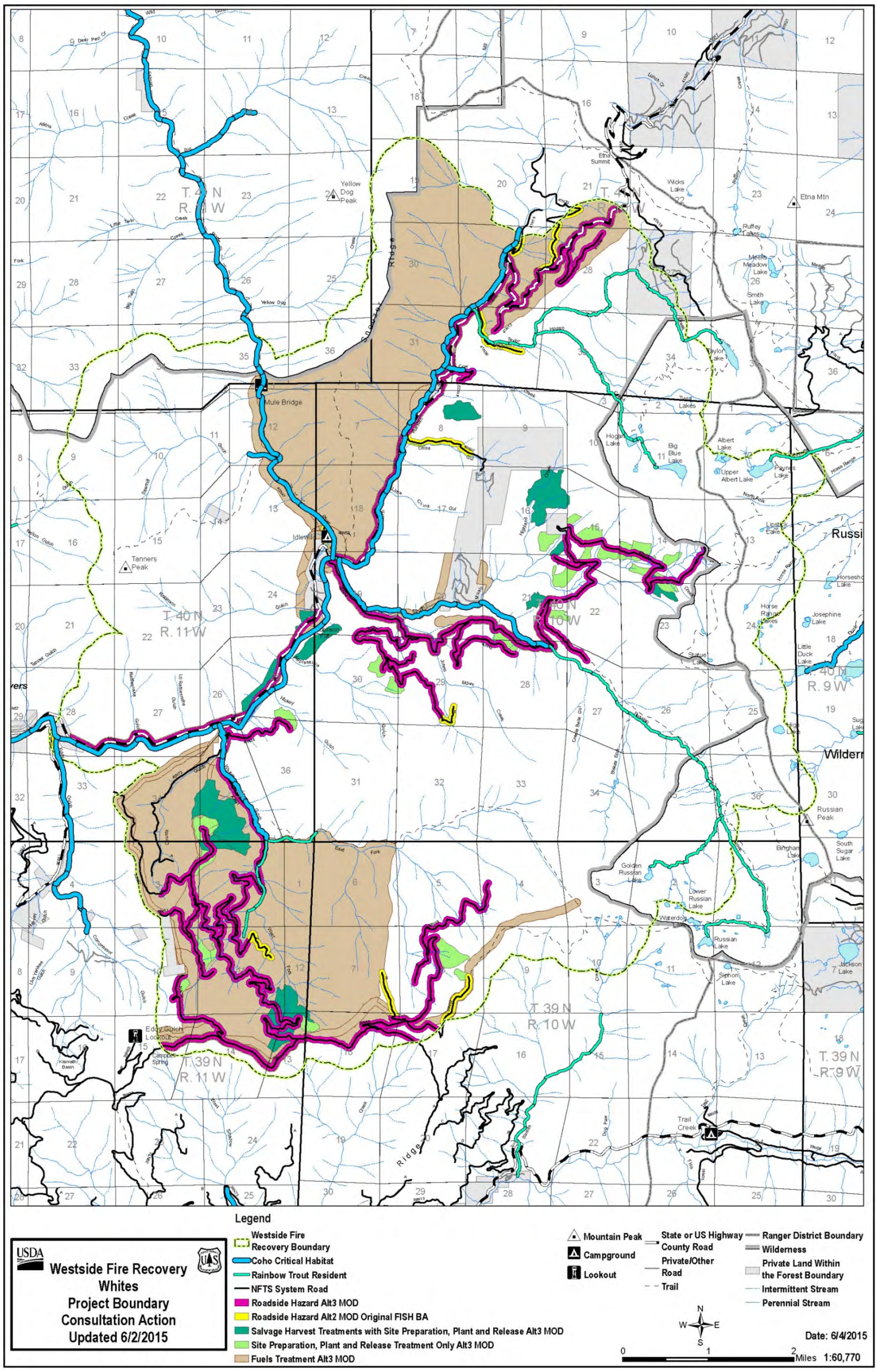

Map H-13: Map of Whites area submitted with the Fisheries BA (July 2, 2015)

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National Marine Fisheries Service Letter of Non-Concurrence Received on July 22, 2015

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1655 Heindon Road
Arcata, California 95521-4573

JUL 2 2 2015 In response refer to: WCR-2015-2518

Ms. Patricia Grantham
Forest Supervisor
Klamath National Forest
1711 South Main Street
Yreka, CA 96097

Re: Endangered Species Act Section 7(a)(2) Non-Concurrence Letter for the Westside Fire Recovery Project in Siskiyou County, CA.

Dear Ms. Grantham:

On April 16, 2015, NOAA's National Marine Fisheries Service (NMFS) received the final biological assessment (BA) for the Westside Fire Recovery Project (Project) along with your request for a written concurrence with the Unites States Forest Service's (USFS) determination that the Project is not likely to adversely affect (NLAA) the Southern Oregon / Northern California Coastal (SONCC) coho salmon (*Oncorhynchus kisutch*) evolutionarily significant unit (ESU) listed under the Endangered Species Act (ESA) as threatened (70 FR 37160; June 28, 2005), or its critical habitat (64 FR 24049; May 5, 1999). On June 22, 2015, NMFS then received a USFS addendum to the Project, which clarified Project revisions that included both a reduction in Project treatment acreage and an increase in resource protection measures since submission of the original Project BA.

Based on this information, NMFS cannot concur with USFS' determination that the project is not likely to adversely affect listed species and designated critical habitat. Our analysis has determined salvage logging operations in harvest units 5, 23, 32, 39, 55, 56, 57, 59, 64, 226, 268, 406, 520, 524, 525, and 530 may contribute to the risk of landslides and/or debris flows. Further increases in sediment loading into salmon bearing streams and rivers of the Action Area are of concern as it may adversely affect listed salmonids. If the possibility of adverse effects to SONCC coho salmon or its critical habitat cannot be eliminated, USFS is required to request initiation of formal consultation with NMFS.

If you have questions concerning this non-concurrence letter, please contact Jim Simondet, Klamath Branch Supervisor by phone at (707) 825-5171, or via e-mail at jim.simondet@noaa.gov.

Sincerely,

for

William W. Stelle Jr.
Regional Administrator

cc: Copy to ARN file # 151422WCR2015AR00120

Forest Service Response to Letter of Non-Concurrence Sent July 24, 2015

USDA United States Department of Agriculture
Forest Service
Klamath National Forest
Supervisor's Office
1711 S. Main Street
Yreka, CA 96097-9518
530-842-6131
TDD: 530-841-4573

File Code: 2670
Date: July 24, 2015

William W. Stelle Jr.
Regional Administrator
National Marine Fisheries Service
1655 Heidon Road
Arcata, CA 95521-4573

Dear Mr. Stelle:

The Klamath National Forest (KNF) received your non-Concurrence letter of July 22, 2015 concerning the Biological Assessment (BA) for the Westside Fire Recovery Project. This non-Concurrence letter states your disagreement with the level of effect analysis in the BA. The Forest Service's determination in the BA is "not likely to adversely affect" (NLAA) the Southern Oregon/Northern California Coastal (SONCC) coho salmon evolutionarily significant unit listed under the Endangered Species Act as threatened, or its critical habitat. The National Marine Fisheries Service (NMFS) does not concur with the KNF determination due to NMFS concerns that harvest operations in units 5, 23, 32, 39, 55, 56, 57, 59, 64, 226, 268, 406, 520, 524, 525, and 530 may contribute to the risk of landslides and/or debris flows. As a result of your July 22nd letter, I requested project biologists review the current BA with respect to your concerns regarding the 16 timber salvage units identified. Project biologists confirmed that the timber salvage units identified, while containing landslide features, were field verified by our Forest geologist to ensure treatment actions would not adversely affect slope stability in that area. In addition, the Forest geologist also confirmed that planting and retaining trees on those high severity burn areas was the single most beneficial, stabilizing action that could be taken on those landslide features.

We believe our BA accurately depicts project effects and that the appropriate determination for affects to SONCC is NLAA. We acknowledge that NMFS disagrees with this determination. Given that the only way this important project is able to move forward at this time is for us to request formal consultation, please consider this letter as such a request. It is imperative that formal consultation move forward rapidly in order to implement this project while it is still feasible. The Forest will provide the NMFS with any available information that would be useful in performing their analysis for the biological opinion.

Please contact Dan Blessing, Natural Resources Staff Officer, at (530)841-4521.

Sincerely,

PATRICIA GRANTHAM
Forest Supervisor

cc: James Simondet

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